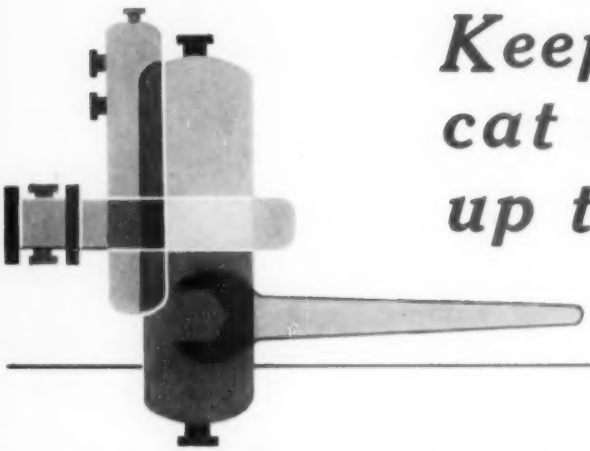
the OIL AND GAS JOURNAL

JULY 2, 1956



Keeping the cat cracker up to snuff

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INTEGRITY

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MANUFACTURERS AND ERECTORS
SINCE 1913

A Glance Ahead . . . . at press time

These trends will make TOMORROW'S NEWS

Competition for 1957 engineering and science graduates is already on. The shortage has led some companies to pay bonuses or put prospective employes on the payroll while they are still in college. Recruiters on some campuses outnumber the graduates.

One major reason for the industrywide shortage of technical men is underscored by a recent Carnegie Tech alumni survey. Eighty-three per cent of Tech's engineering and science graduates have deserted their field.

Costs of fractionating straight-chain from branched-chain hydrocarbons are getting a long look from refiners and natural-gasoline processors.

The process is necessary unless feed stock is very high in straight-chain content. But it can run over 75 per cent of capital and operating costs when low-octane normal paraffins are recycled essentially to extinction in order to yield a high concentration of high-octane isomers.

Development companies are considering improved distillation concepts and selective techniques involving adsorption, absorption and microfiltration.

New plastic pipe-coating materials are nearing the field-test stage. They still must prove their practical value for pipeliners. But one of the recent novelties developed is a plastic sheet put on pipe with a zipper.

Possibility of warm-water floods elsewhere is being talked in wake of Lewis report on enormous payout for the process in Alberta's Pembina field.

Look for application of the method at old Turner Valley in the near future. Plans already are in the mill for a complete reexamination of the Turner Valley reservoirs. Of an estimated billion barrels of oil in place, only 110 million barrels has been recovered. Another 23 million barrels is expected under primary recovery up to 1983.

Refiners are finding bright stocks a drug on today's market. Trend is growing toward lighter distillate lube-oil fractions in modern automotive equipment. Pressure is on the refiner to convert his residual bright-stock fractions to distillates for blending into multigrade oils. Researchers investigating the problem report a promising approach is catalytic hydrogenation of crude residues to produce lubricating distillates.

Refiners and marketers are wary about jumping into a super-premium third grade of gasoline inaugurated by Esso Standard, Humble, and Standard of Kentucky.

Many are adopting a policy of wait and see. Sun still has made no move to expand marketing of multigrades from a single pump. Standard of Ohio and Texaco say flatly they're not planning the third grade now. Mid-Continent refiners are standing pat but feel they may have to boost octanes of their premium fuels if trend becomes firmly established in East and Gulf Coast.

Rush could develop all over if those offering third grade move heavy gallonage at higher prices during current motoring season.

Despite improvement at some points in tank-car prices, gasoline price wars continue to plague refiners. Distress sales by small refiners are a minor factor. Main cause stems from volume race of larger refiners who sell to those who undersell them in retail markets and who precipitate price wars.

The OIL AND GAS JOURNAL

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TECHNOLOGY—OPERATION

Pipelining

Displacing Oil With Natural Gas in Crude Lines **93**

By A. M. Hill

Service Pipe Line's schedule for dismantling 775 miles of old crude lines called for displacing the line in bad weather. Natural gas was used, since water could freeze in the line and in the pumping equipment. Results were good.

Pipeline Patrol: Making Flow-Efficiency Tests **127**

By Larry Resen

Here's a report on a panel discussion centered around these questions: what is the best method to follow in making pipeline flow efficiency tests, what precaution should be taken, and what you do with results?

Drilling-Production

LOST-CIRCULATION SYMPOSIUM **80-89**

You **Can** Reduce Lost-Circulation Problems **80**

By E. H. Clark, Jr.

Lost circulation may occur because of excessive mud-weight buildup, poor mud conditioning, fast pipe handling, and mud-pump shock pressures. Analysis must be made of what is happening at the bottom of the hole in each case in order to minimize loss of circulation during drilling.

How To Find Lost-Circulation Zones **85**

By C. F. Gallagher

Zones of lost circulation may be located with spinner surveys, radioactive-tracer methods, temperature surveys, lost-circulation detectors, and fluid velocity indicators. Here are details of the know-how in using these methods.

How To Handle Lost Circulation **88**

By C. C. Liedholm

The driller can combat lost circulation by drilling without returns, using preventive methods, and attempting to regain circulation after its loss. The best method depends upon the area and the individual well.

For Better Fracturing Results, Control That Fluid Loss **102**

By J. G. Davis, J. J. Reynolds, and H. P. Coffer

Fluid loss is critical in fracture extension. Field results show that treatments with low-fluid-loss fracturing fluids give better results than do conventional treatments of equal size. Fluid loss has more affect on fracture extension than either injection return or the viscosity of fracturing fluid.

Calculation of Oil In Place in Reef Reservoirs **109**

By Richard W. Hillyer

The procedure is quite simple. Instead of selecting an arbitrary point of delineation between pay and nonpay, porosity, permeability, and connate-water values would be totaled and an average value obtained for each.

Fracturing May Get Assist By Removing Reservoir Salt **111**

Refining-Processing

Welding on Catalytic-Cracking Units During Operation **90**

By J. S. Clarke

The first of a series of six articles on maintenance of catalytic-cracking units. Welding can be done safely during operation provided proper precautions are taken. Safe procedures for preparation steps and additional welding operations must be carefully worked out.

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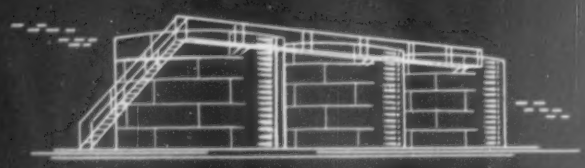

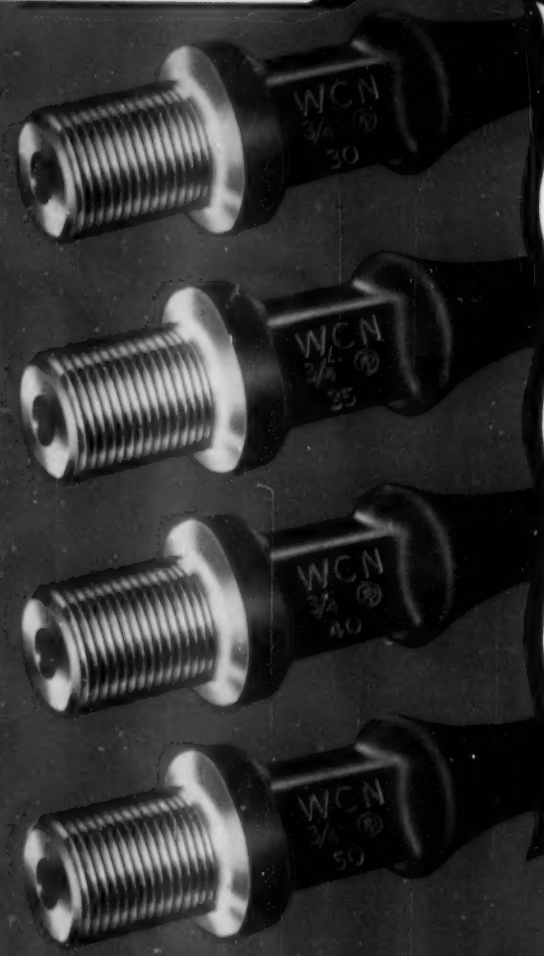

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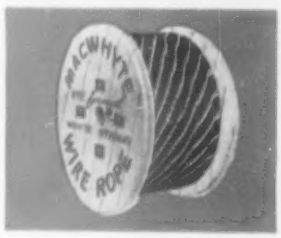

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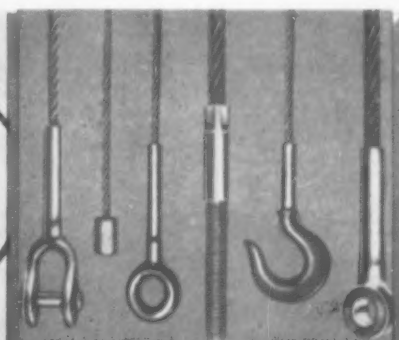

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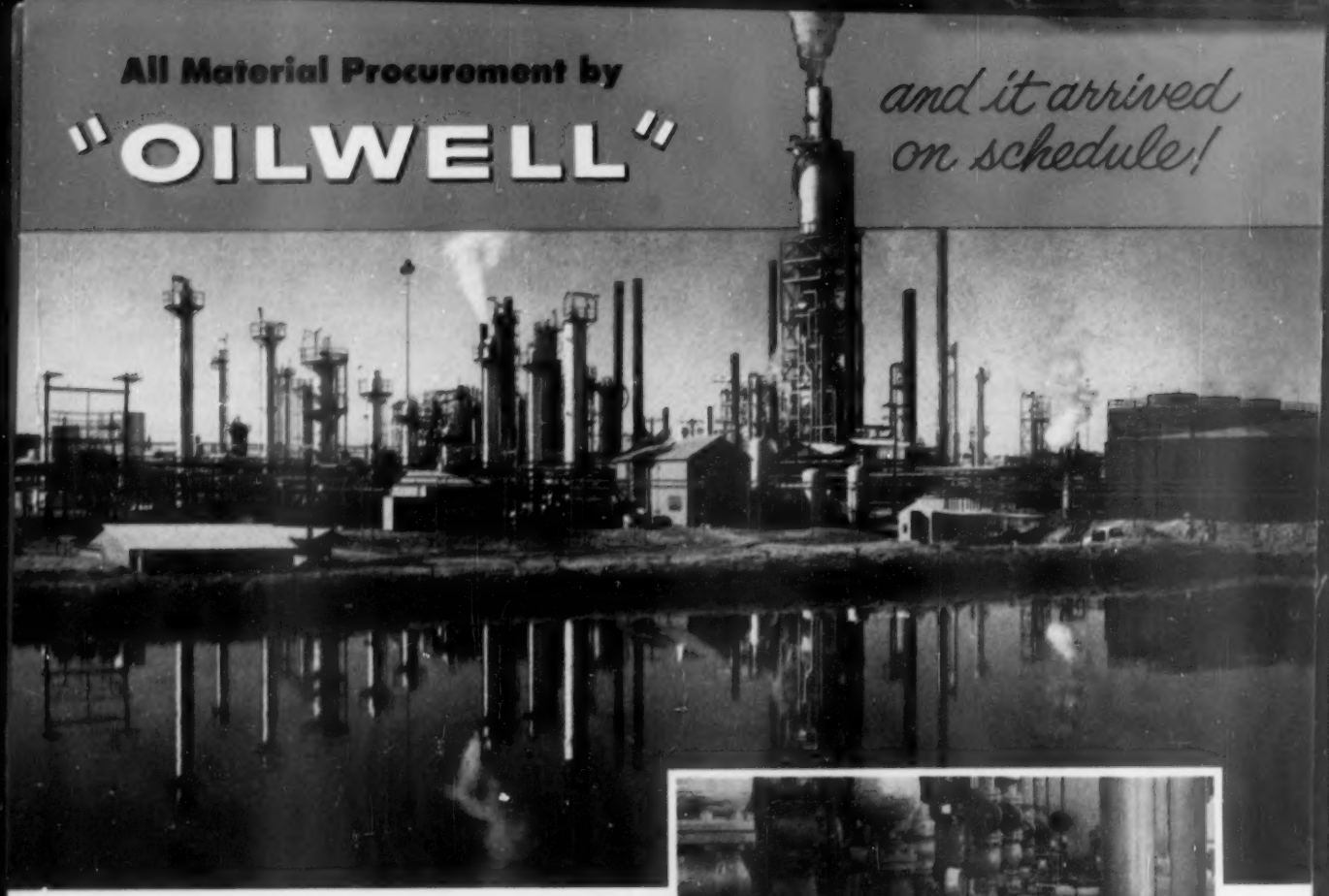

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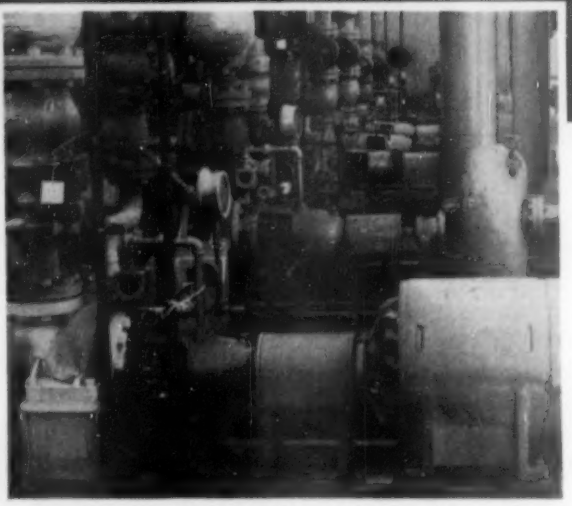

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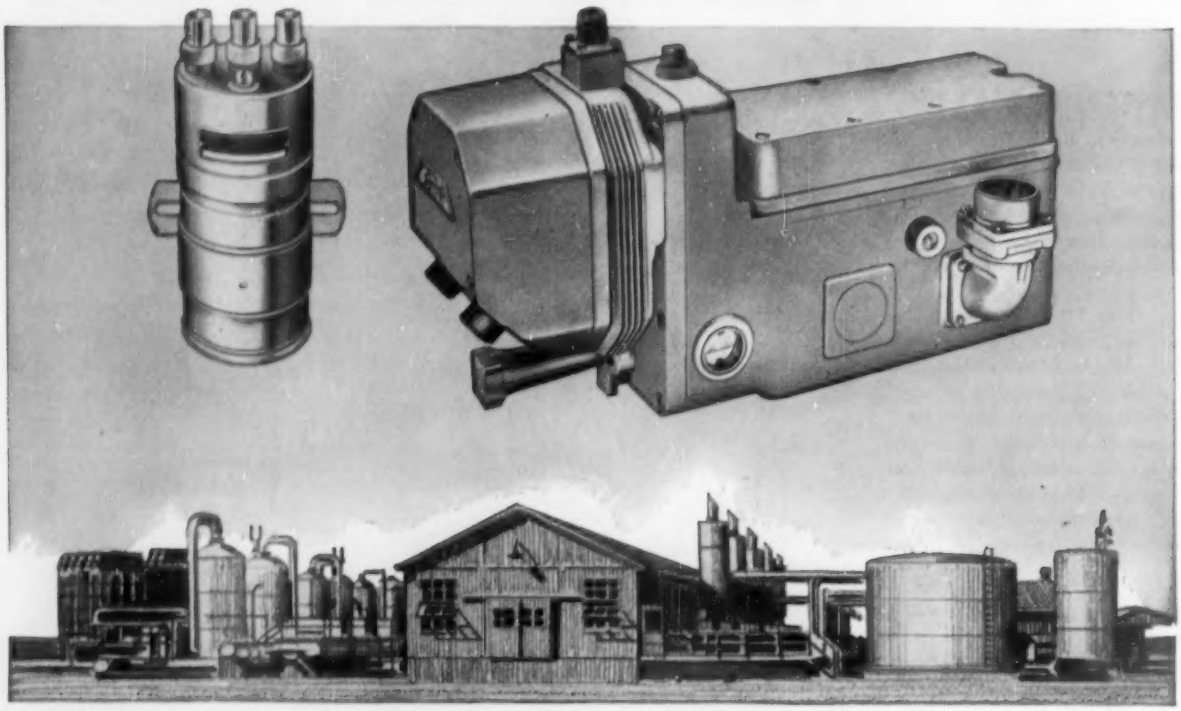

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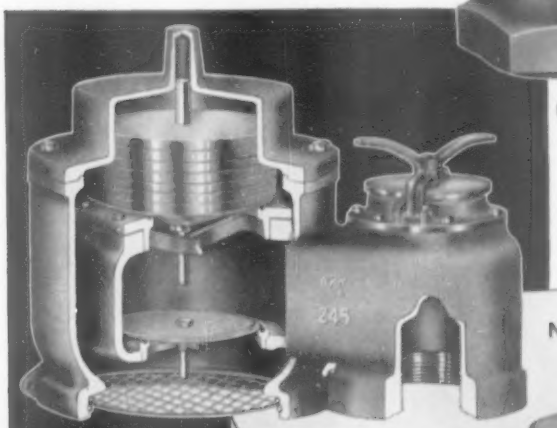

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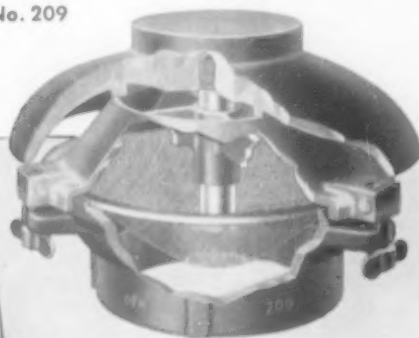

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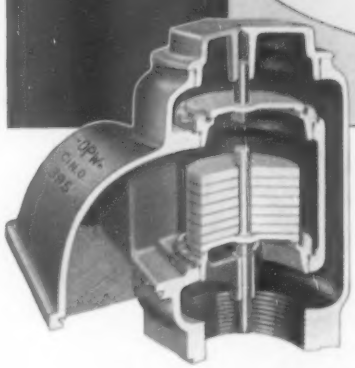

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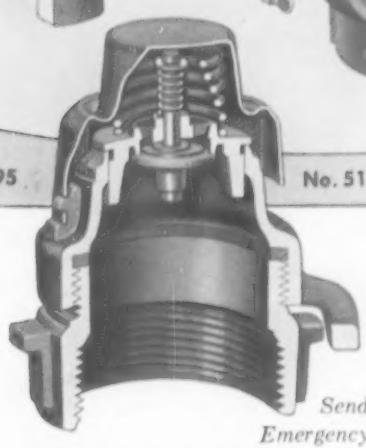

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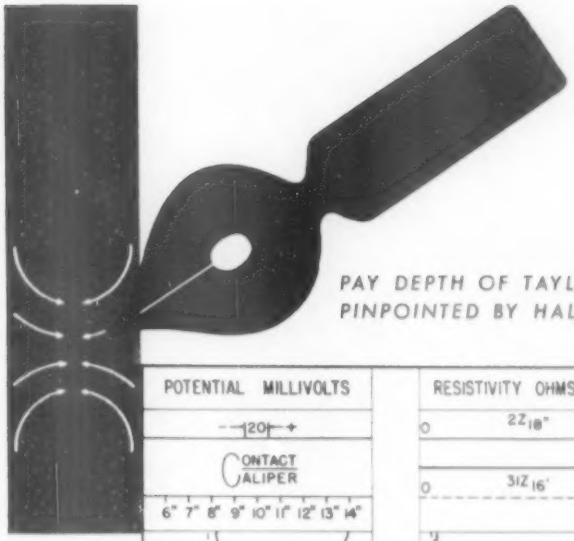
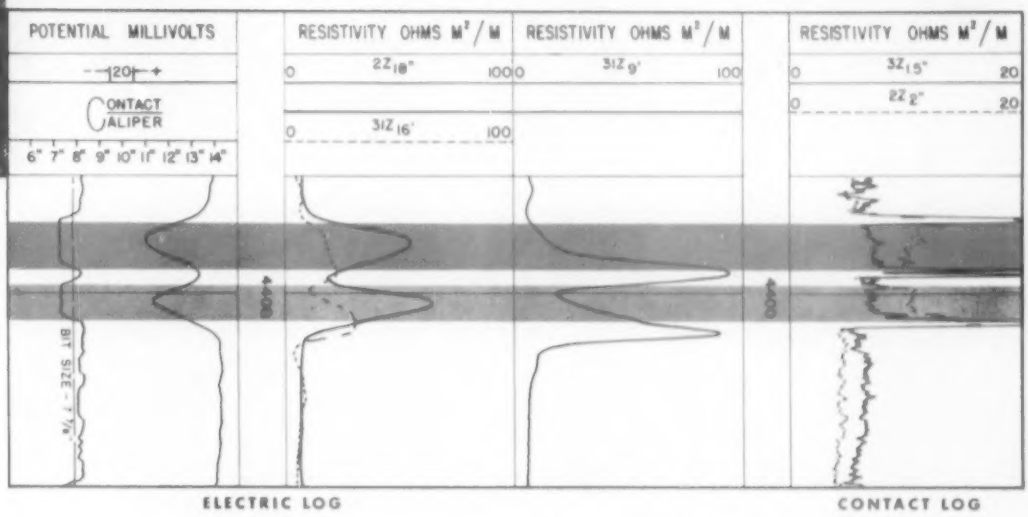


log analysis like this

VERIFIED WITHIN 3.2 PERCENTAGE POINTS

PAY DEPTH OF TAYLOR COUNTY PRODUCER PINPOINTED BY HALLIBURTON LOG



RESERVOIR EVALUATION

DEPTH 4382-93'	FROM CORES	FROM LOGS	DEPTH 4398-4407'	FROM CORES	FROM LOGS
Porosity	17.7%	15.0%	Porosity	14.1%	14.9%
Water Saturation	* 20.0%	17.0%	Water Saturation	* 22.0%	16.0%
Maximum Mobile Hydrocarbons in Situ (Bbls./Acre-foot)	*822	730	Maximum Mobile Hydrocarbons in Situ (Bbls./Acre-foot)	*657	740

PRODUCING INTERVAL: 4380-88'
Initial Production: 130 BOPD through 14/64" choke
GOR: 300-1 — no water

*Connate water saturations and maximum mobile hydrocarbons reported from core data were estimated from fluid content of cores.

This well in Taylor County, Texas, verified Halliburton log analysis as agreeing with core readings for porosity and water saturation within less than 3.2 average percentage points. Certainly close enough for basing sound development decisions. Many Halliburton analyses come even closer.

Interval selected for perforation from this information produced 130 barrels a day . . . confirming importance of using a dependable, forward-moving electric well logging service. A service that never knows too much to learn new lessons in well logging.

This type of analysis is being performed every day by Halliburton EWS operators for oilmen everywhere.

COMPLETE DATA SENT ON REQUEST

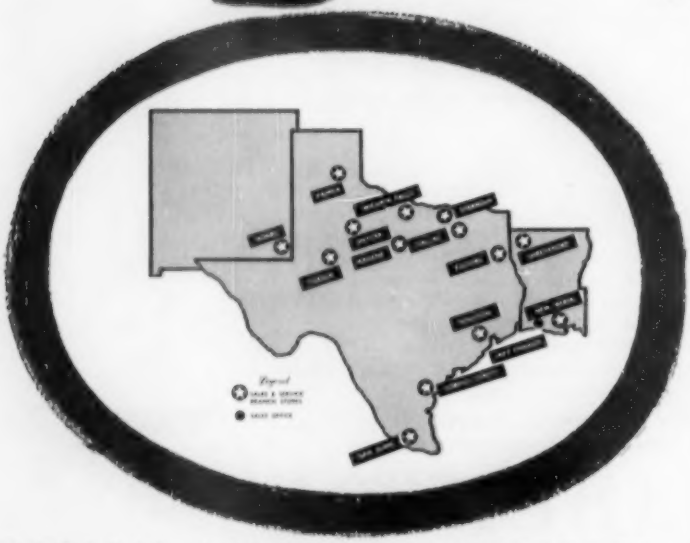
Add this valuable information to your Halliburton Service File

HALLIBURTON

ELECTRICAL WELL SERVICES

POWER and SERVICE ARE PARTNERS

Dependable power by Waukesha engines and first rate, efficient service by Waukesha Sales & Service, Inc., form a partnership that can't be beat. Waukesha Sales & Service, Inc., has completely stocked parts warehouses and repair service facilities located throughout Texas, Louisiana and New Mexico at centers of drilling activity to provide 'round the clock service for your Waukesha engines. So remember Waukesha Sales & Service, Inc., when you want the best in engines and service for your power needs.



WAUKESHA

Sales & Service, Inc.

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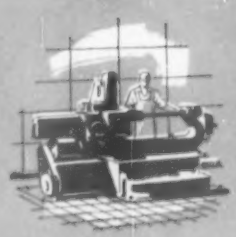
EXCLUSIVE DISTRIBUTORS FOR WAUKESHA PRODUCTS IN TEXAS, NORTH AND WESTERN LOUISIANA, SOUTHERN ARKANSAS AND NEW MEXICO

WORLD'S LARGEST DISTRIBUTOR OF OIL FIELD ENGINES

A complete line of Roller Bearings . . .

For every field of transportation and industry

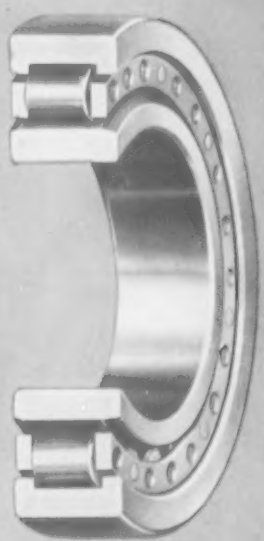


Job-tailored in a wide range of sizes to fit your specific needs

Aircraft? Automobiles? Earth-moving or farm equipment? *Whatever* you make, if your product uses straight or tapered roller bearings, Bower can meet your specifications *exactly*. For dependable Bower bearings are virtually custom-built to the job . . . engineered and sized to match any requirement.

Important, too, are exclusive Bower design features that assure long life, top performance, *less maintenance*. And when you specify Bower bearings you can always be certain of the highest quality materials and workmanship. These reasons, of course, are why Bower straight, tapered and journal roller bearings are used by leading manufacturers everywhere—for any application.

Let a Bower engineer give you full details of the complete Bower line. Call him in while your product is still in the design stage.



BOWER ROLLER BEARINGS

BOWER ROLLER BEARING DIVISION • *FEDERAL-MOGUL-BOWER BEARINGS, INC., DETROIT 14, MICH.*

power

83.6

This Powerforming unit, designed and constructed by Foster Wheeler for Esso's Baltimore refinery, charges approximately 3,000 barrels per day of heavy virgin naphtha which has been desulfurized in a Hydrofining unit whose operation is integrated with that of the Powerformer.

FOSTER

NEW YORK • LONDON

forming

percent, 98* clear

*Research Octane of Debutanized Reformate

- **New, more active platinum catalyst**
- **Special regenerative technique maintains optimum catalyst activity**
- **Lower pressure operation – 200 to 300 psig**
- **Higher yields of high octane reformate**

This combination provides the refiner with a most effective means for the catalytic reforming of low-octane naphthas into high-octane motor fuel components.

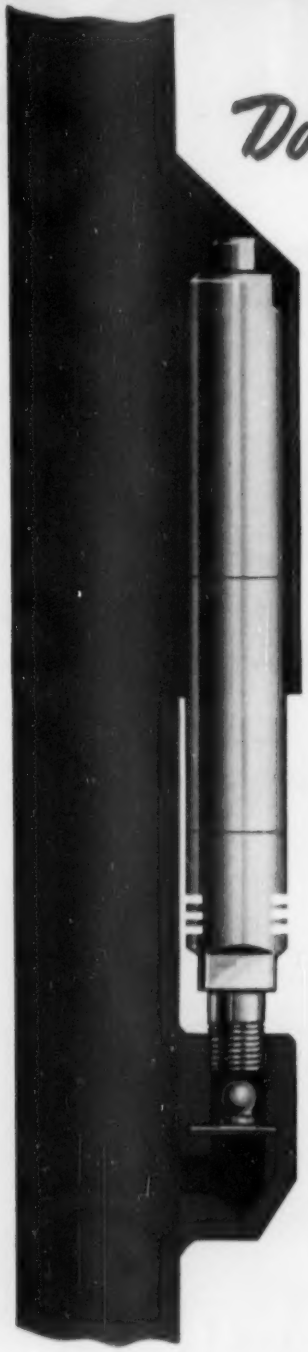
Powerforming, developed by Esso Research and Engineering, has already proved its outstanding performance on three units which are now in successful operation. Fourteen more are under construction or in the design and planning stage.

The first Powerforming unit, shown at the left, in operation since May 1955 was designed and constructed by Foster Wheeler for Esso's Baltimore refinery. FW is currently providing mechanical design and construction for two more Powerforming units — a 20,000 barrel per day unit at the Bayway refinery and a 7,000 barrel per day unit at Imperial's Halifax refinery where Foster Wheeler is also building Crude Distillation, Fluid Catalytic Cracking, Polymerization and Treating units. For further information write to *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*

WHEELER

PARIS • ST. CATHARINES, ONT.

GUIBERSON DOES IT!



Double Duty Type 'A' Flow Valve

With Tungsten Carbide Ball and Seat

produces continuous or intermittent flow with only a surface equipment adjustment

Install Type "A" on any continuous flow operation. When production falls to a level where intermittent flow is required—*a simple surface adjustment* produces well with maximum efficiency and economy. No need to round trip tubing to change valves.

Guiberson Surface Control Equipment...

is designed and built specifically for gas lift. Rugged, weatherproof Type "A" Motor Valve and Time Cycle Controller or Pressure Controller are easy to get to, easy to operate, easy to adjust.

Write today for the new
GUIBERSON GAS LIFT MANUAL

Guiberson Gas Lift Equipment is protected by the following patents:
2,156,429 2,227,192 2,292,768 2,347,620 2,377,981
2,168,656 2,230,107 2,305,290 2,350,944 2,411,315
2,180,966 2,271,000 2,340,028 2,361,718 2,519,242
Other patents pending.

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GUIBERSON
CORPORATION
ESTABLISHED 1919 • DALLAS, TEXAS, U. S. A.
Sold By Leading Oil Field Supply Stores Everywhere

For the deepest wells considered today:

Timken® seamless steel tubing, with yield strength of 125,000 psi!

TIMKEN® seamless steel tubing can be furnished with a yield strength of 125,000 psi —20% stronger than the strongest grade called for in API specification 5A. Able to withstand internal pressures up to 15,000 psi, Timken seamless steel tubing is strong enough for the deepest wells being considered today.

Whatever your specific oil well tubing problem, Timken seamless steel tubing provides a ready solution. You may order from a wide variety of sizes and analyses, some of which are chosen for corrosion resistance, and all are ductile when properly heat treated.

Timken seamless steel tubing is already in use in several extremely deep or high pressure wells. Results have been highly satisfactory. For more than 24 years we have been making high pressure seamless tubing for many other special requirements.

FREE ENGINEERING STUDY . . . Get your free copy of "Timken Oil and Gas Well Tubing", a study of various alloys for high strength and corrosion resistant tubing, made by Timken Company metallurgists. Write to: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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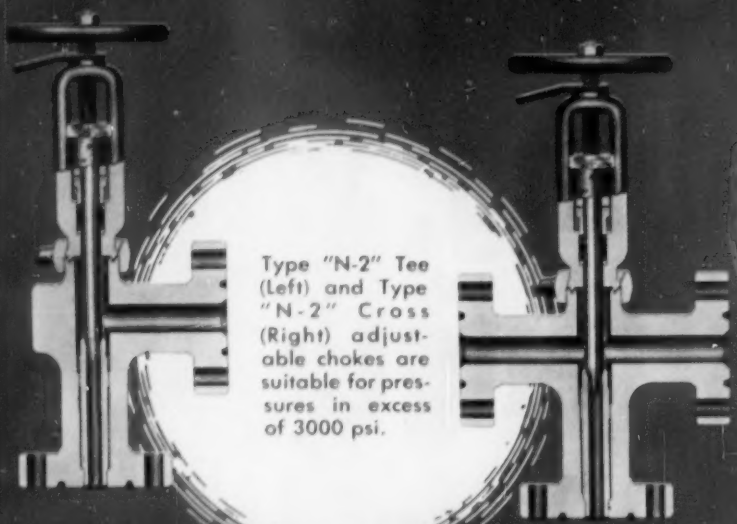
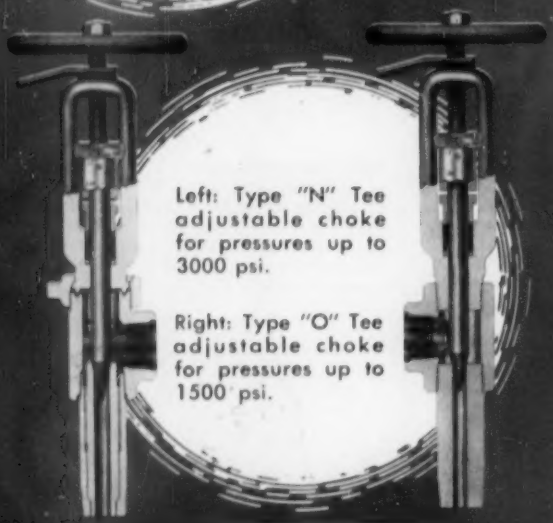
SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

O·C·T offers a complete

ADJUSTABLE CHOKES

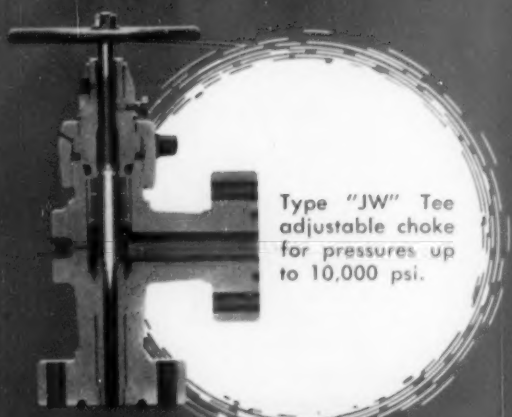


Type "N-2" Tee (Left) and Type "N-2" Cross (Right) adjustable chokes are suitable for pressures in excess of 3000 psi.



Left: Type "N" Tee adjustable choke for pressures up to 3000 psi.

Right: Type "O" Tee adjustable choke for pressures up to 1500 psi.



Type "JW" Tee adjustable choke for pressures up to 10,000 psi.

ALL SIZES

0.0273"

to 2¼"

ALL PRESSURE RATINGS

1,500 psi to 30,000 psi

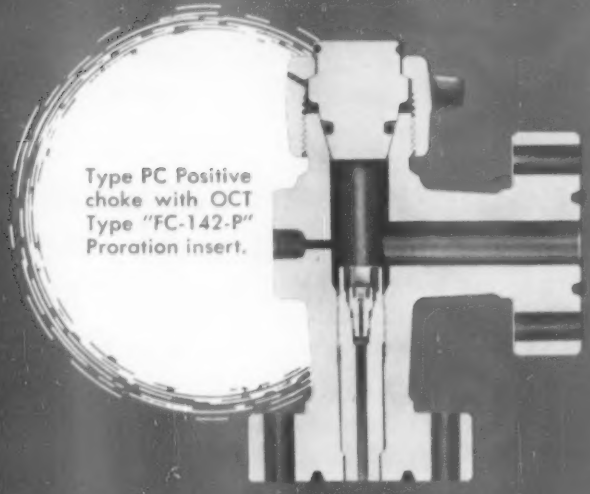
line of chokes...and every one is the best of its kind!

OCT Type "FC-25" Positive flow beam.

OCT Type "FC-140" Cage nipple and flow bean.

POSITIVE CHOKES

OCT makes a complete line of cross and tee choke fittings in all popular sizes and all pressure ratings, as well as a complete line of cage nipples, flow beans, and proration inserts. Most choke fittings will accommodate either positive flow beans or adjustable choke assemblies. This interchangeability reduces the inventory of parts required to service wells in a given field.



Type PC Positive choke with OCT Type "FC-142-P" Proration insert.

OCT Type "FC-142-P" Proration insert.

ALL parts of OCT Chokes are carefully made of materials best suited to the requirements of the well. Precision machining assures maximum safety as well as interchangeability of parts.

ALL MATERIALS

OCT Chokes are made in a complete range of materials from special analysis steel for general duty to tungsten carbide, monel or stainless steel for "problem" applications.

O·C·T

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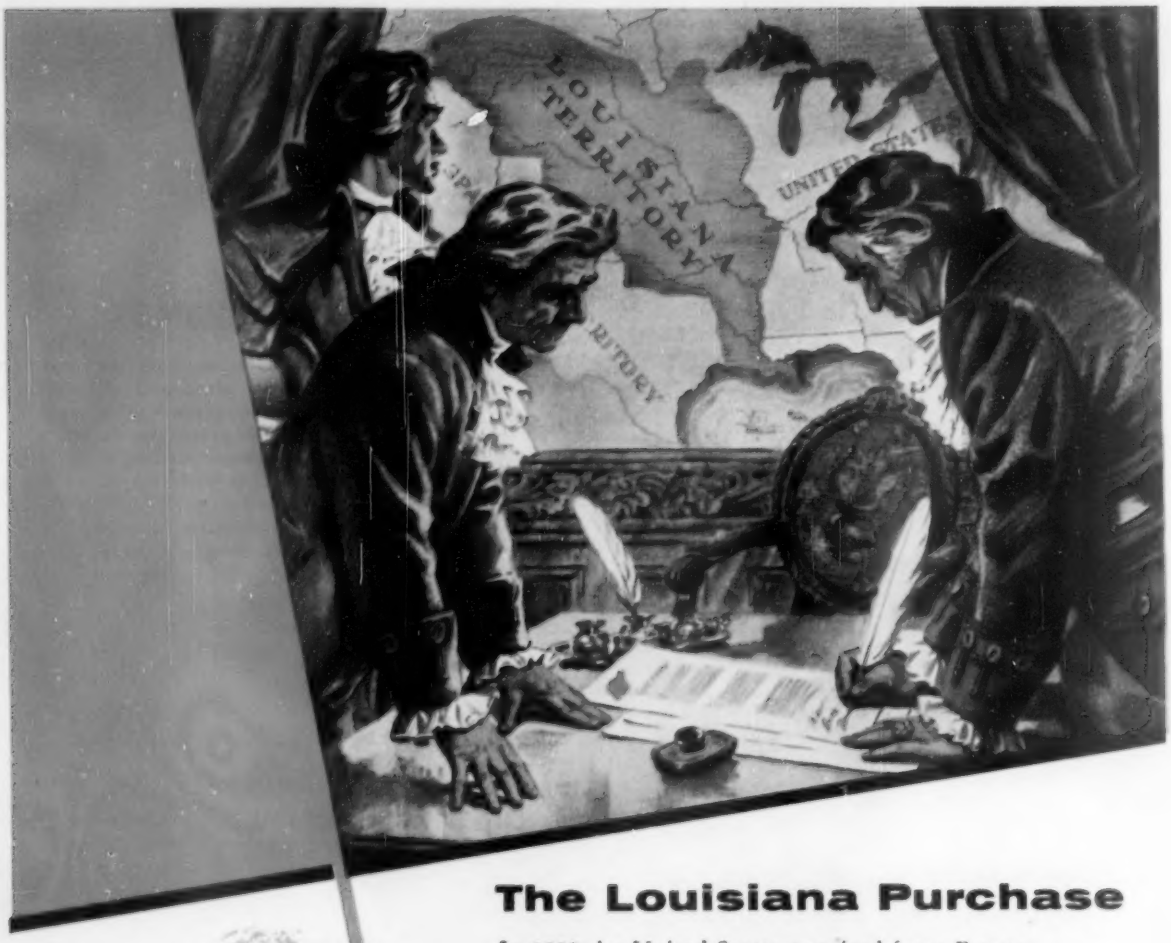
P. O. Box 3091, Houston, Texas

Export Representatives: Sterling Areas — Le Grand, Sutcliff & Gell, Ltd., Rochester, Kent, England. South America—East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.



The Louisiana Purchase

In 1803 the United States acquired from France the vast area known as the Louisiana Territory. The price was eighty million francs . . . about $15,000,000, and the purchase almost doubled the area of the United States.

Since 1914 the Texas Employers' Insurance Association has saved and returned to policyholders over $46,000,000 in Dividends and Guaranteed Cost Discounts . . . more than *three* times the amount involved in the Louisiana Purchase. $3,855,678 was saved and returned to employers of labor in Texas in 1955 alone.

Many members of the Oil and Gas Industry are taking advantage of the SAVINGS on Workmen's Compensation Insurance offered by Texas' largest writer. Are YOU?

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Saved and Returned to
POLICYHOLDERS

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INSURANCE ASSOCIATION
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Service Offices: ABILENE • AMARILLO • AUSTIN • BEAUMONT • CORPUS CHRISTI
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Get greater profits
starting with your next fracture job

Adomite*

Adomite is a revolutionary fluid-loss control additive for converting lease crudes to superior fracturing fluids. It has already been used successfully in over 1,000 fracture jobs in different fields.

Ask your service company to use Adomite on your next fracture job

© Continental Oil Company.

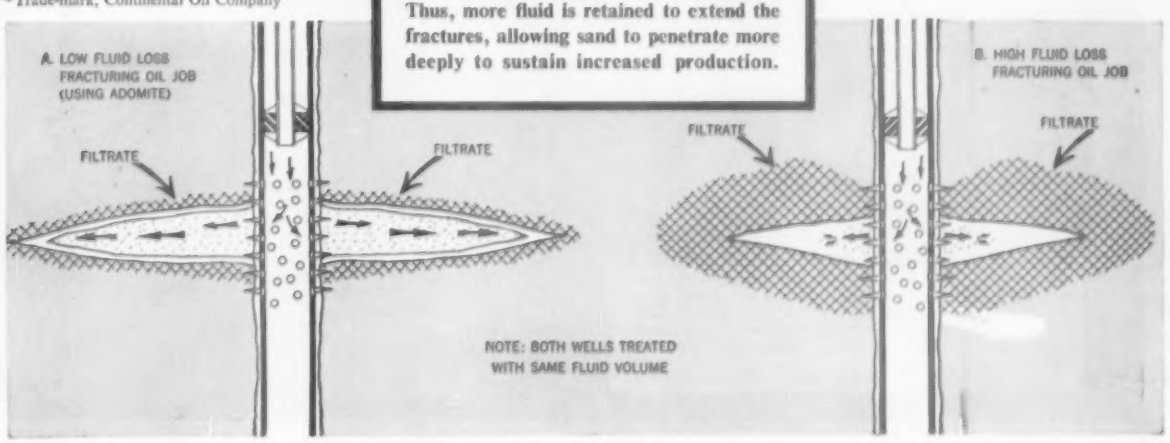
HOW ADOMITE BENEFITS PRODUCERS

- Effectively seals the fracture face and practically prevents loss of fluid into the producing formation.
- Results in longer fractures and deeper penetration of sand for a given job.
- Cleans up rapidly. Does not contaminate the produced oil or the formation.
- Greater sustained production with a given fluid volume at lower cost.
- Equally effective in oils which have or have not been treated with emulsion breakers.
- Easy to use. Adomite is a dry material in flake form. It is mixed directly into the crude or gelled crudes on the lease, using only standard mixing equipment.

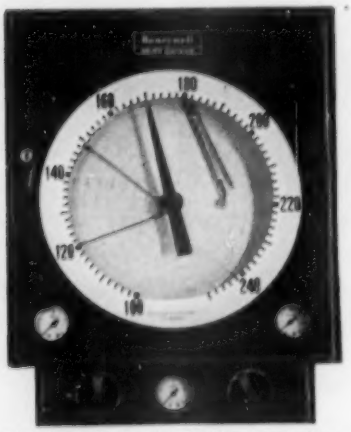
HOW IT WORKS

Adomite retards fluid loss into the formation. Thus, more fluid is retained to extend the fractures, allowing sand to penetrate more deeply to sustain increased production.

*Trade-mark, Continental Oil Company


A. LOW FLUID LOSS FRACTURING OIL JOB (USING ADOMITE)
FILTRATE
FILTRATE
B. HIGH FLUID LOSS FRACTURING OIL JOB
FILTRATE
FILTRATE
NOTE: BOTH WELLS TREATED WITH SAME FLUID VOLUME

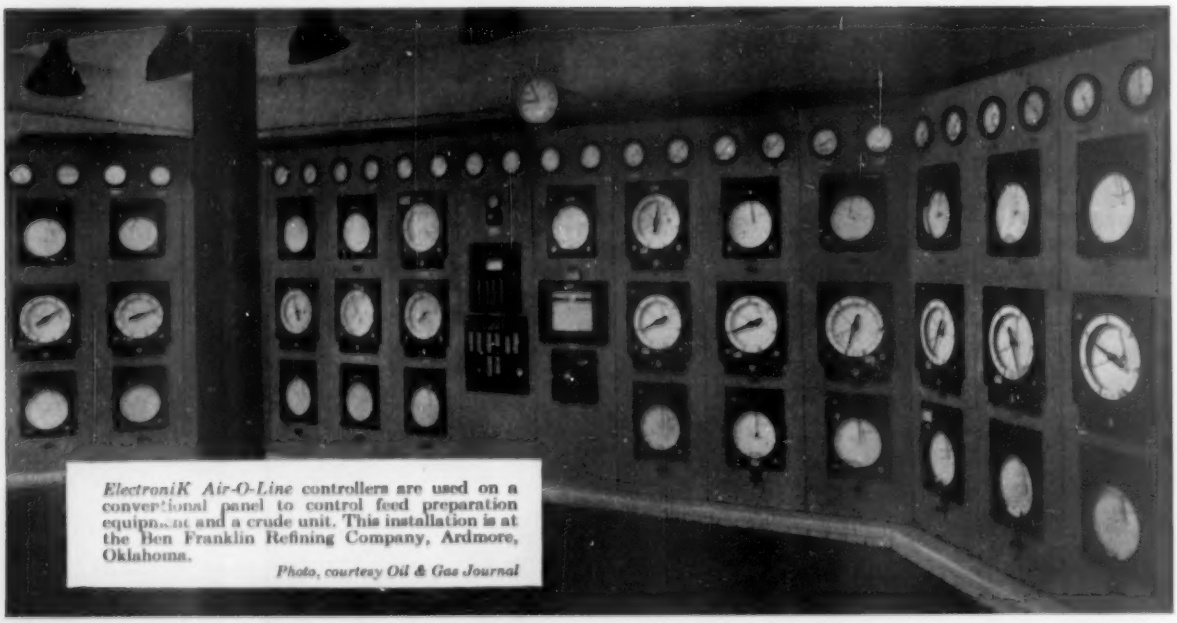
Strip chart *Air-O-Line* controller gives you up to a 30-day record, which you can tear off daily, if you prefer. Graduated chart width is 11 inches. By-pass panel, for switching from "Automatic" to "Manual," is integrally mounted.



Circular chart *Air-O-Line* controller provides a daily or weekly record. Large pointer and scale are easy to read. Graduated chart width is 4½ inches. By-pass panel, for switching from "Automatic" to "Manual," is integrally mounted.

ElectroniK

Air-O-Line controllers make tough

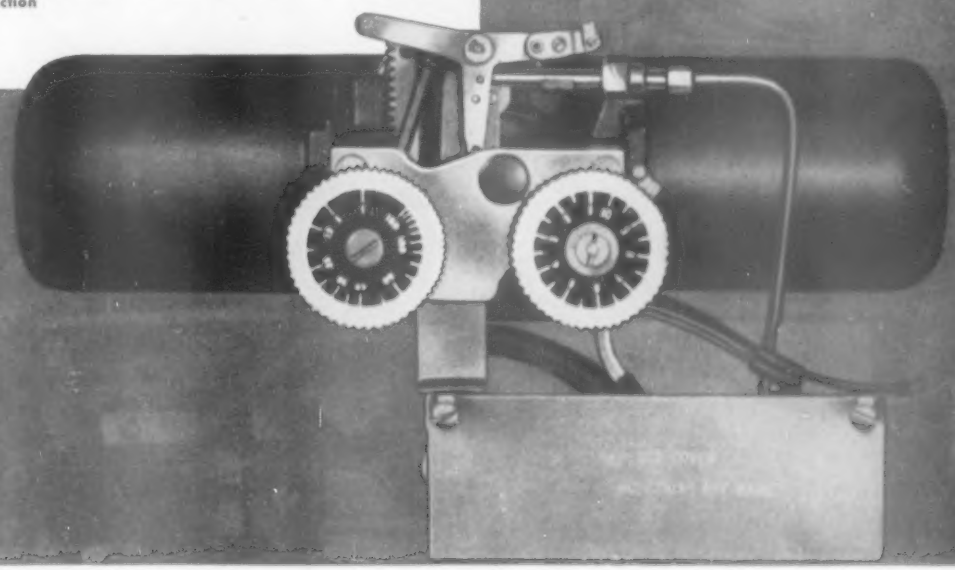


ElectroniK Air-O-Line controllers are used on a conventional panel to control feed preparation equipment and a crude unit. This installation is at the Ben Franklin Refining Company, Ardmore, Oklahoma.

Photo, courtesy Oil & Gas Journal

ElectroniK Air-O-Line FEATURES

- Pneumatic proportional-plus-reset control
- Proportional band widths adjustable from 1 to over 200%
- Automatic reset rates from 0 to 14 repeats per minute
- Factory-calibrated within limits of ±0.2%
- Hermetically sealed converter
- Totally enclosed balancing motor
- Sealed liquid-filled *Air-O-Line* unit with single, clog-free restriction



refinery control jobs easy

are accurate to within ±0.2% . . . provide fast, sensitive control

HERE'S an instrument that will handle your critical refinery control jobs reliably and with hairline accuracy. Sensitive to changes as small as 3 parts in 10,000, this controller holds the measured process variable right where it belongs.

ElectroniK Air-O-Line controllers measure and control temperature, pressure, flow—*any* variable that can be changed into a d-c signal. By standardizing on this controller for your most critical processes, you can greatly simplify your spare parts stocking and maintenance. The same components are used in both strip and circular chart models.

A typical application of the *ElectroniK Air-O-Line* instrument is the control of oil heater outlet temperature. The controller resets the set point index of a fuel flow controller on oil-fired heaters . . . operates a pressure-balanced control valve in the fuel line of gas-fired heaters. In either case, it holds outlet temperature within extremely narrow limits.

Maintenance? Hardly any with the *ElectroniK Air-O-Line* controller. Dirt, dust, and dampness are sealed out. Vibration won't affect operation. The three main components of the *ElectroniK* instrument — amplifier, converter and balancing motor—can be easily replaced if necessary.

These controllers have proved themselves in thousands of tough applications. They're the product of pioneering experience in electronic instrumentation for the petroleum refining industry . . . made by the world's largest instrument manufacturer . . . backed by the world's largest instrument service organization. Call in your local Honeywell sales engineer to talk over your application. He's as near as your phone.

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and you'll readily see why operators favor Utility Electric Power. Field after field of pumping wells are NOW COMPLETELY ELECTRIFIED. With wells powered AUTOMATICALLY by Utility Electric Power these operators have the added advantages of less manpower, less maintenance, and less over-all operating costs. Be sure of power when and where you need it... but be sure you make it Low Cost Utility Electric Power.

Petroleum Electric Power Association

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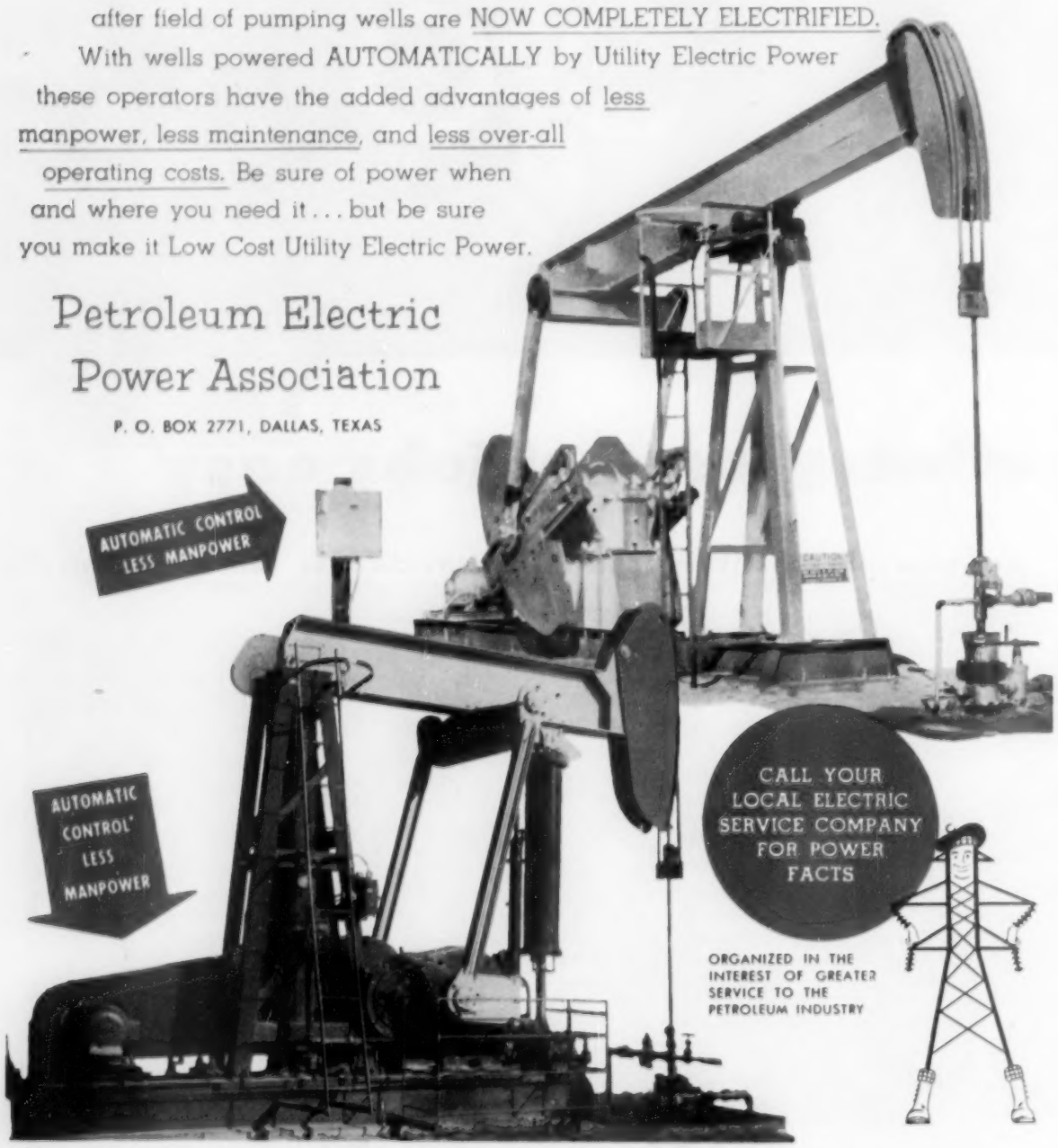
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CALL YOUR LOCAL ELECTRIC SERVICE COMPANY FOR POWER FACTS
ORGANIZED IN THE INTEREST OF GREATER SERVICE TO THE PETROLEUM INDUSTRY

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Dow is the one producer, you know, supplying caustic soda to industry everywhere. Wherever you produce, you're *sure* of getting rapid, dependable service from Dow.

Modern, geographically distributed Dow plants protect your *purchasing*. Whether from Midland, Michigan; Freeport, Texas; Pittsburg, California . . . whether 73% or 50% solution, solid, regular, ground or fine flake . . . you get caustic at its uniform, high-purity best. This constant quality protects your *processing*.

Then, too . . . Dow customers everywhere benefit from continual process research, flexible delivery network, prompt field technical service when needed. Does Dow have *your* order? THE DOW CHEMICAL COMPANY, Dept. AL 755C, Midland, Michigan.

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DOW

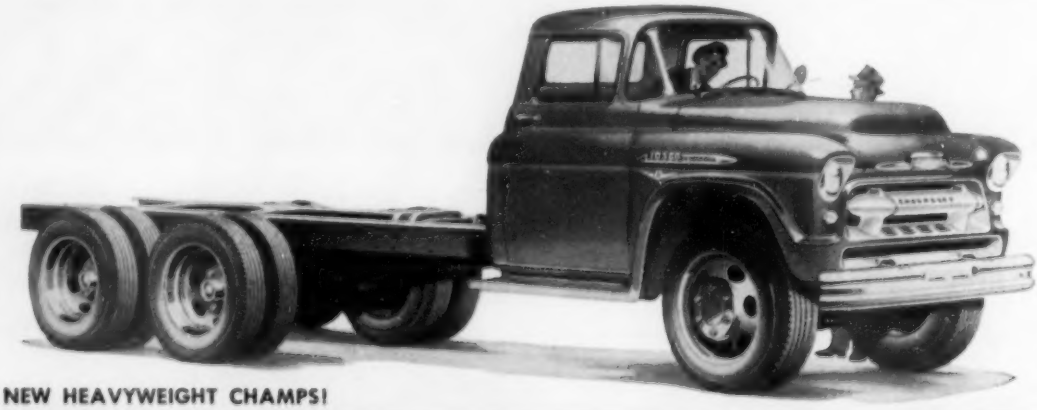
Now there's a great automatic for whichever Chevy truck you

Famous Chevrolet ***Hydra-Matic,*** or all-new ***Powermatic,*** provides easy, safe automatic driving that's tailored for your truck!

Pick *any* Chevrolet truck . . . and you'll find there's a modern automatic transmission to make your hauling easier, safer, and more profitable than ever!

For instance, if your choice is a Series 3000 or 4000 truck, there's ***Hydra-Matic.*** This modern automatic transmission eliminates manual gear shifting, gives you the ease of no-clutch hauling. It saves you maintenance money, too, because the hydraulic coupling protects universal joints, rear axle gears and shafts, rear tires and engine parts from shock loads. And, by automatically selecting the proper gear ratio for the road and load, ***Hydra-Matic*** gets you where you're going faster—saves you time!

Or, if your job calls for a 5000 through 10000 Series Chevy, there's exclusive ***Powermatic***—the first automatic transmission designed especially for big trucks! Unlike conventional or semi-automatic transmissions, ***Powermatic*** *works for you all the time.* Six fully automatic forward speeds and a torque converter virtually eliminate manual gear shifting on hills! A revolutionary "retarder" assures



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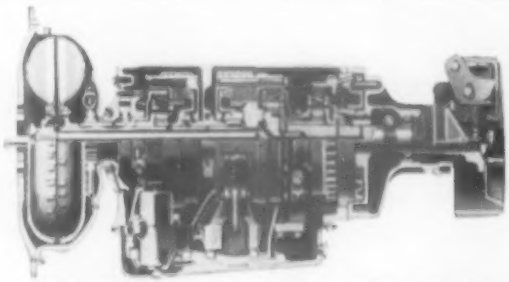
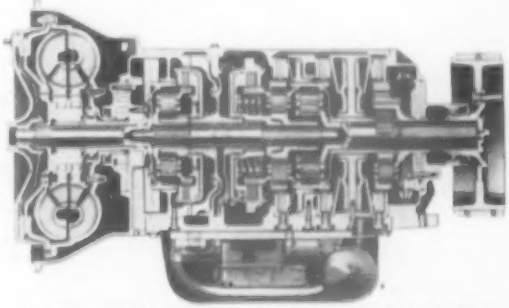
CHEVROLET **NEW CHEVROLET**

Anything less is an

transmission choose



Hydra-Matic—optional in Series 3000 and 4000 trucks—brings new ease to tough jobs, cuts hauling time and maintenance expense.



Powermatic—optional in Series 5000-10000 models—assures the easiest, safest big-truck operation ever known! It's a Chevrolet "first."

Exclusive *Powermatic* Retarder makes downhill hauling safer, saves brakes! Most hills can be descended without touching the brakes . . . and most normal slowdowns can be made by the retarder alone!

safer downhill hauling, far less brake wear. You'll make better time through traffic because all shifts are "power-on" shifts. And ***Powermatic*** is designed to aid top-notch economy on the highway!

And Chevrolet truck *conventional* transmissions are great performers, too! For extra pulling power in medium- and heavy-duty models, Chevrolet provides big, rugged heavy-duty 4-speed Synchro-Mesh transmissions, or brand-new "New Process" 5-speed transmissions!*

This wide selection of advanced transmissions is one more reason why Chevrolet trucks serve you better, one more reason why you should see your Chevy dealer soon! . . . Chevrolet Division of General Motors, Detroit 2, Mich.

**Optional in 5000 through 8000 Series models, standard in 9000-10000 Series models.*

TASK·FORCE TRUCKS

old-fashioned truck!

New! Low-Cost! Camco "Series K" gas-lift mandrels, tools and selectively retrievable valves handle even dual completion jobs in small casings down to 5½"—17#. Details from Camco, Inc., 7010 Ardmore St., Houston, Texas.

How Monel Alloys Improve CAMCO Gas-Lift Devices

With Monel*, "R" Monel* or "KR" Monel* Alloys, Camco "Series K" retrievable gas-lift devices are strengthened and given outstanding resistance to well corrosives and erosives

Monel is used in the valve to resist corrosion by sour crudes, brines and other well corrosives.

"R" Monel is used to do the same for valve parts which must be automatically machined at high speeds.

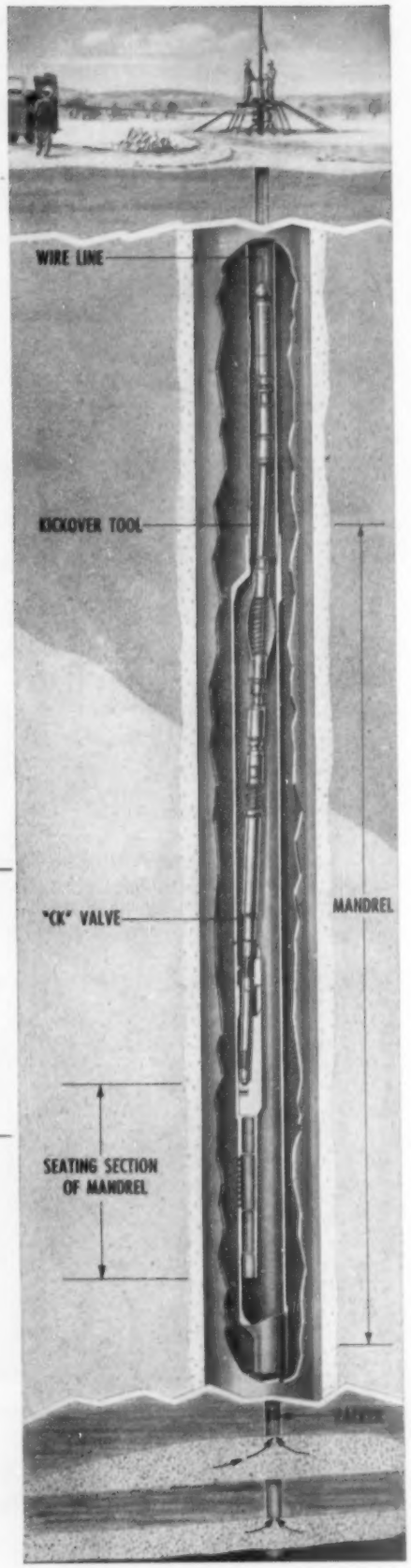
"KR" Monel is used in both valve and kickover tool where a highly corrosion-resisting alloy is needed that can be freely machined and then heat-treated to withstand wear and impact.

Monel and other Inco Nickel Alloys are used in thousands of locations and many different types of drilling and refining equipment. *They have proven uniquely resistant to corrosion, and well able to meet a wide range of severe physical requirements.* For assistance in their application, contact Inco's Development and Research Division.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO Nickel Alloys

*Registered trademarks: (1) Monel, nickel-copper alloy; (2) "R" Monel, a free machining grade of Monel; (3) "KR" Monel, an age-hardenable free machining grade of Monel.



In DYNALOG Instruments, a simple, variable, radio-type capacitor replaces the troublesome slidewire — gives unmatched smoothness of balancing.

This potentiometer has no slidewire

STEPLESS CAPACITY-BALANCING

ELIMINATES SLIDEWIRE MAINTENANCE

DYNALOG'S* EXCLUSIVE BALANCING ACTION

- no slidewire
- no batteries.
- no standardizing
- no gears, cables, etc.
- no high-speed reversing motor

There's no need to put up with worn slidewires and sticking electrical contacts . . . no need to periodically clean and lubricate balancing motors. DYNALOG design eliminates all this! Its simple variable capacitor and positive magnetic drive provide *continuous, stepless* balancing . . . *never* require attention!

DYNALOG's friction-free action provides high speed of response without wear. (There are only five moving parts, including the recording pen!) Sensitivity, unlimited by turns of slidewire winding, is 1/100 of 1%. And accuracy is a sustained 1/4 of 1%.

DYNALOG Instruments are available for use with resistance, voltage, capacity, or inductive type primary elements to measure and/or control any process variable . . . with unmatched smoothness. Write for Bulletin 427. The Foxboro Company, 607 Neponset Ave., Foxboro, Mass., U.S.A.

*Reg. U.S. Pat. Off.

FOXBORO

*Reg. U.S. Pat. Off.

DYNALOG

ELECTRONIC INSTRUMENTS

"Tiger Brand is the best drilling line we've ever used,"

says **E. S. Thibodeaux,** *tool pusher*

for O'Meara & Sterling

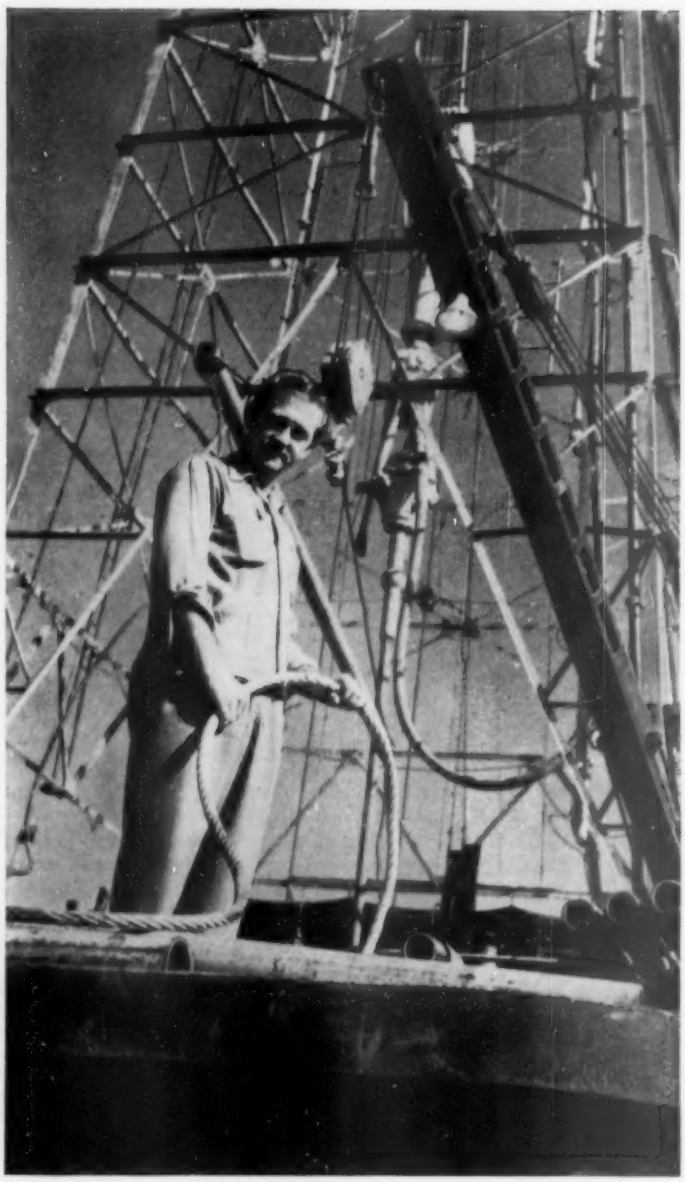
Drilling Contractors

New Orleans, La.

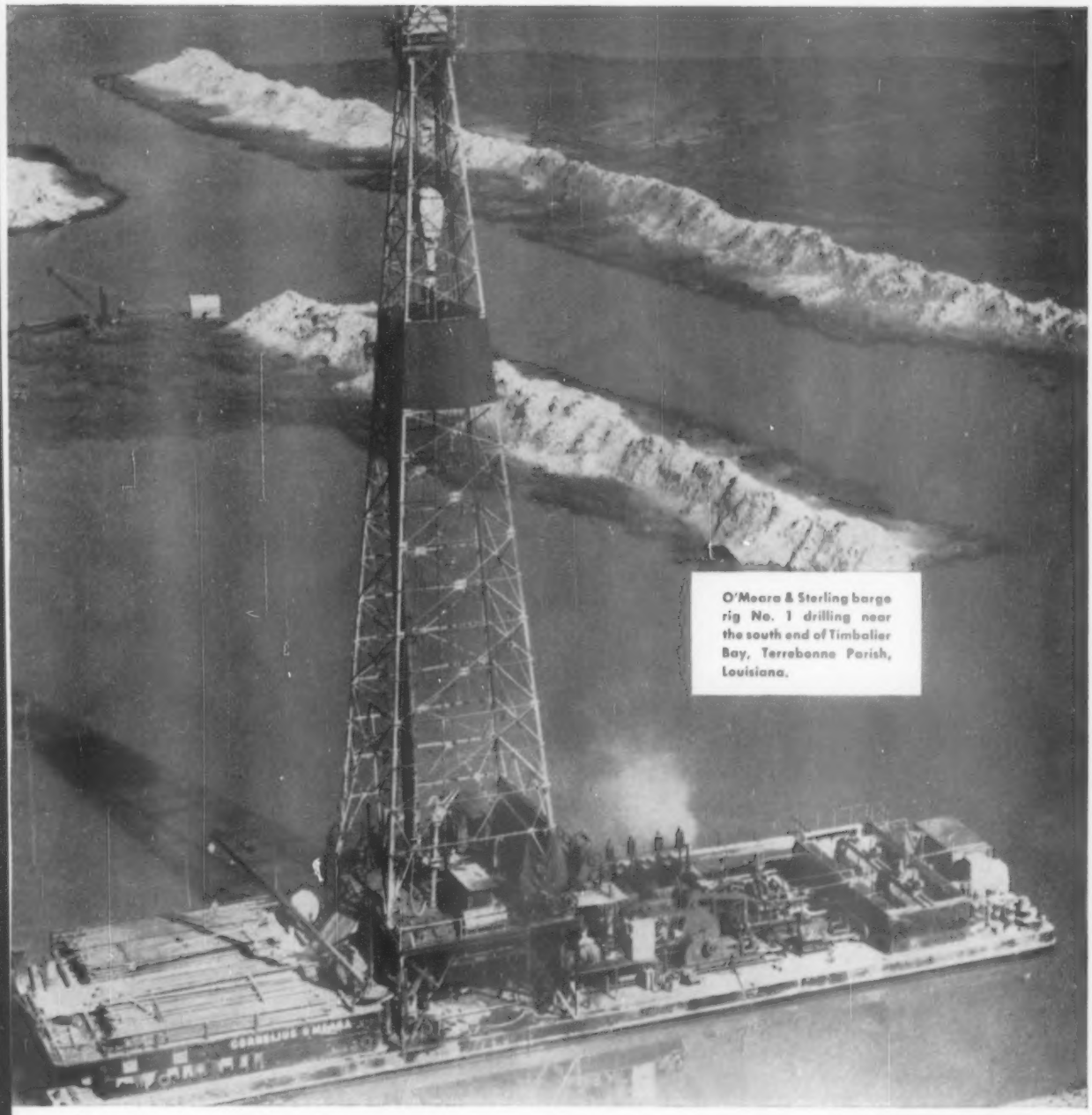
"We went well beyond the maximum service anticipated for any drilling line," continued Mr. Thibodeaux. He was talking about the 3500-foot Tiger Brand 1¼", 6 x 19, Monitor Improved Plow Steel Excellay IWRC drilling line installed on the O'Meara & Sterling Drilling Barge No. 1 near Timbalier Island, Louisiana.

The long service obtained from Tiger Brand drilling line is not confined to a few cases. Similar reports have been obtained from Texas, Oklahoma, Illinois—wherever Tiger Brand is used. The reasons for this are fairly simple: (1) Tiger Brand is made from the best materials obtainable and every process is carefully controlled from ore to finished product, (2) the engineering back of Tiger Brand constructions is unsurpassed in the wire rope field, (3) the Tiger Brand specialists work closely with the users and recommend the best practices to obtain maximum wire rope life.

Why not rig up with Tiger Brand and check its performance on your own rig? Send for our free ton-mile calculator which makes it easy to keep accurate service records. Once you use Tiger Brand Drilling Lines, we're sure you'll be back for more.



E. S. Thibodeaux, tool pusher, says that Tiger Brand Wire Rope gave them the best service of any rope they have ever used.



O'Meara & Sterling barge rig No. 1 drilling near the south end of Timbalier Bay, Terrebonne Parish, Louisiana.

AMERICAN STEEL & WIRE
DIVISION
UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

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American Steel & Wire
Room P-76, Rockefeller Building
Cleveland 13, Ohio

☐ Rush me one free Tiger Brand Ton-Mile Calculator.

☐ Have your representative call to show me how this calculator can help me cut line costs.

Name .....

Firm .....

Address .....

City & State .....

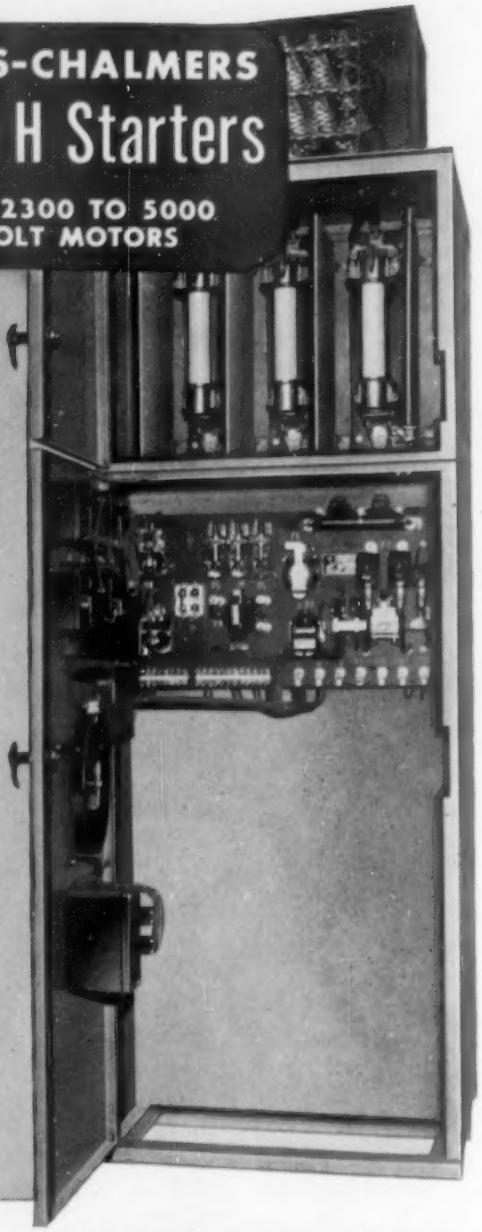
UNITED STATES STEEL

CHOICE of CONTACTORS

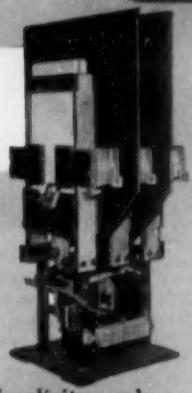
to meet your specific needs

Allis-Chalmers Type H Starters may be equipped with either air-break or oil-immersed contactors —installed in the same sized space.

ALLIS-CHALMERS
Type H Starters
FOR 2300 TO 5000 VOLT MOTORS

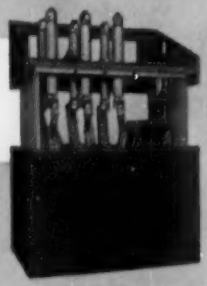


AIR



Designed for top performance on the rough-tough jobs. Advantage of contacts operating in air include long contact life, reduced fire hazard, easy maintenance. Double-break contacts, vertical action and dual blowouts provide long, dependable operation. Design simplicity makes contactor particularly adaptable for applications requiring frequent starting, inching, reversing, or dynamic braking.

OIL



Meets operating demands of semi-hazardous locations. Contactor operates under oil to prevent sparks from igniting atmosphere and to protect mechanism from corrosion. Contactor is time-proved clapper type. Self-cleaning, rolling-wiping action extends contact life. Self-aligning E-type magnet provides perfect armature seating . . . quiet, maintenance-free operation.

YOU GET MORE...

Allis-Chalmers offers help on specific control application problems. Call your Allis-Chalmers representative. His recommendations are backed by Allis-Chalmers engineering departments . . . by the experience gained in solving thousands of control problems . . . by complete research and testing facilities.

For complete information on the Type H starter, write for Bulletin 14B6410B — Allis-Chalmers, General Products Div., Milwaukee 1, Wis.

ALLIS-CHALMERS A-4976

best way to protect pipelines...

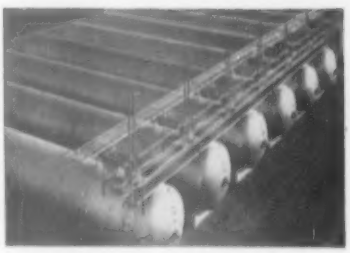
SPECIFY NO-OX-ID

Pipeline installations often represent multimillion-dollar investments. Dependable protection of that investment is of vital importance.

That's why leading pipeline companies and utilities everywhere look to Dearborn NO-OX-ID Coating and Wrapper Combinations for long-term protection—for reliable insurance against corrosion leaks and deterioration.

NO-OX-ID Coatings and NO-OX-ID-ized Wrappers provide chemical and mechanical protection against moisture penetration and soil action . . . protection that lasts for decades . . . on installations under ground or under water.

On your next coating job, you'll find it pays to specify NO-OX-ID.



One application of NO-OX-ID Aluminum Protective Coating keeps outdoor storage tanks bright for years.

Why Does Industry Specify NO-OX-ID?

There are many practical, money-saving reasons NO-OX-ID has such widespread preference:

- NO-OX-ID Coatings can be hot- or cold-applied.
- Fewer "dope" kettles, trucks, and "cats" are needed.
- Saves on material, because less material coats more pipe per mile per day.
- No irritating or noxious fumes.
- Applied by hand, traveling machine or at the mill.

Like to know more?

Then clip and mail the coupon for a factual booklet, "Protecting Underground Pipe from Corrosion with NO-OX-ID and NO-OX-IDized Wrappers." Or, better still, call in your Dearborn Pipeline Engineer and talk it over.

It pays to specify

Dearborn NO-OX-ID®

For Long-Term Pipeline Protection

Dearborn Chemical Company, Dept. OG,
Merchandise Mart Plaza, Chicago 54, Ill.

Gentlemen:

☐ Please have a Dearborn Engineer call.

☐ Send me a copy of "Protecting Underground Pipe from Corrosion with NO-OX-ID and NO-OX-IDized Wrappers."

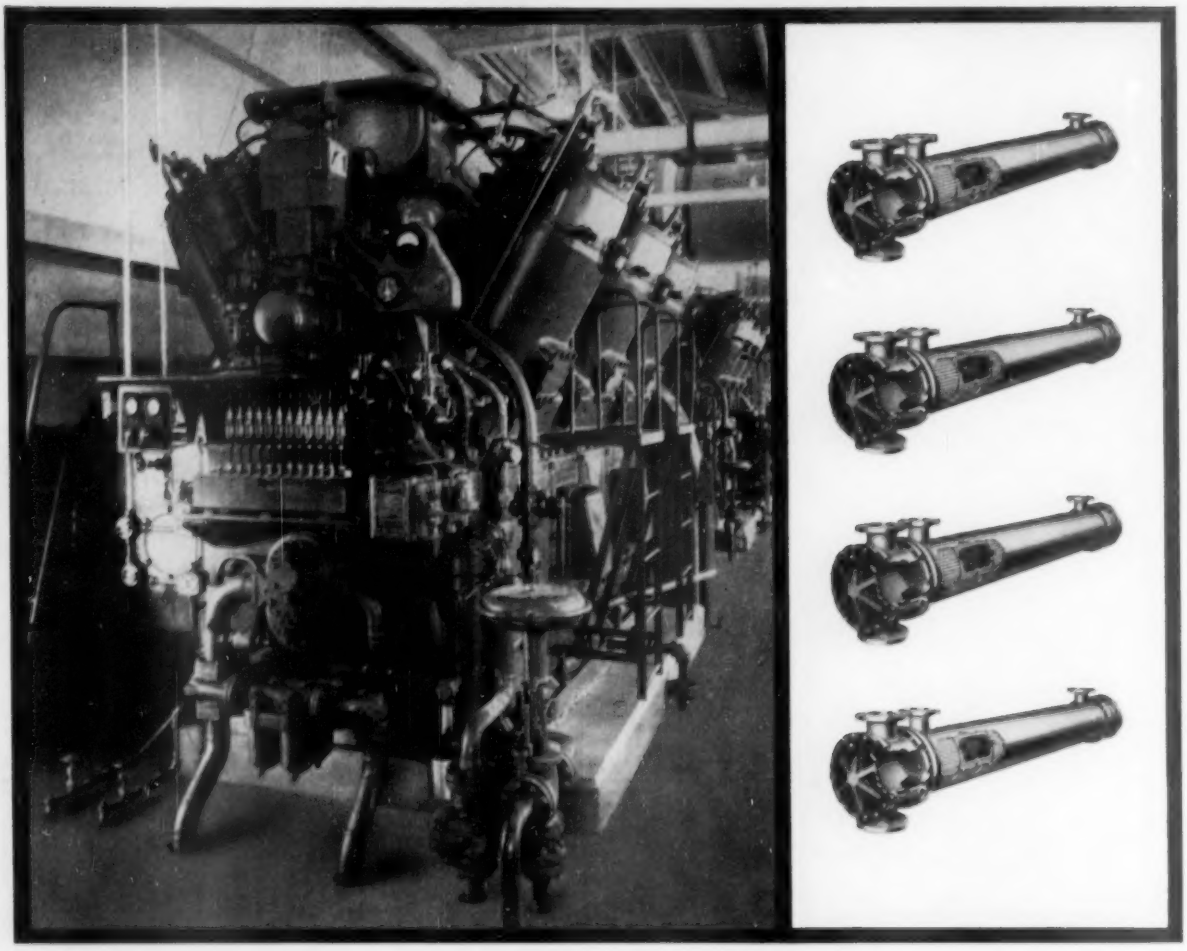
Name.....*Title*.....

Company.....

Address.....

City.....*Zone*.....*State*.....

Extreme reliability demanded here...



Ross Exchangers safeguard lube oil in these 4 Cooper-Bessemer Compressors

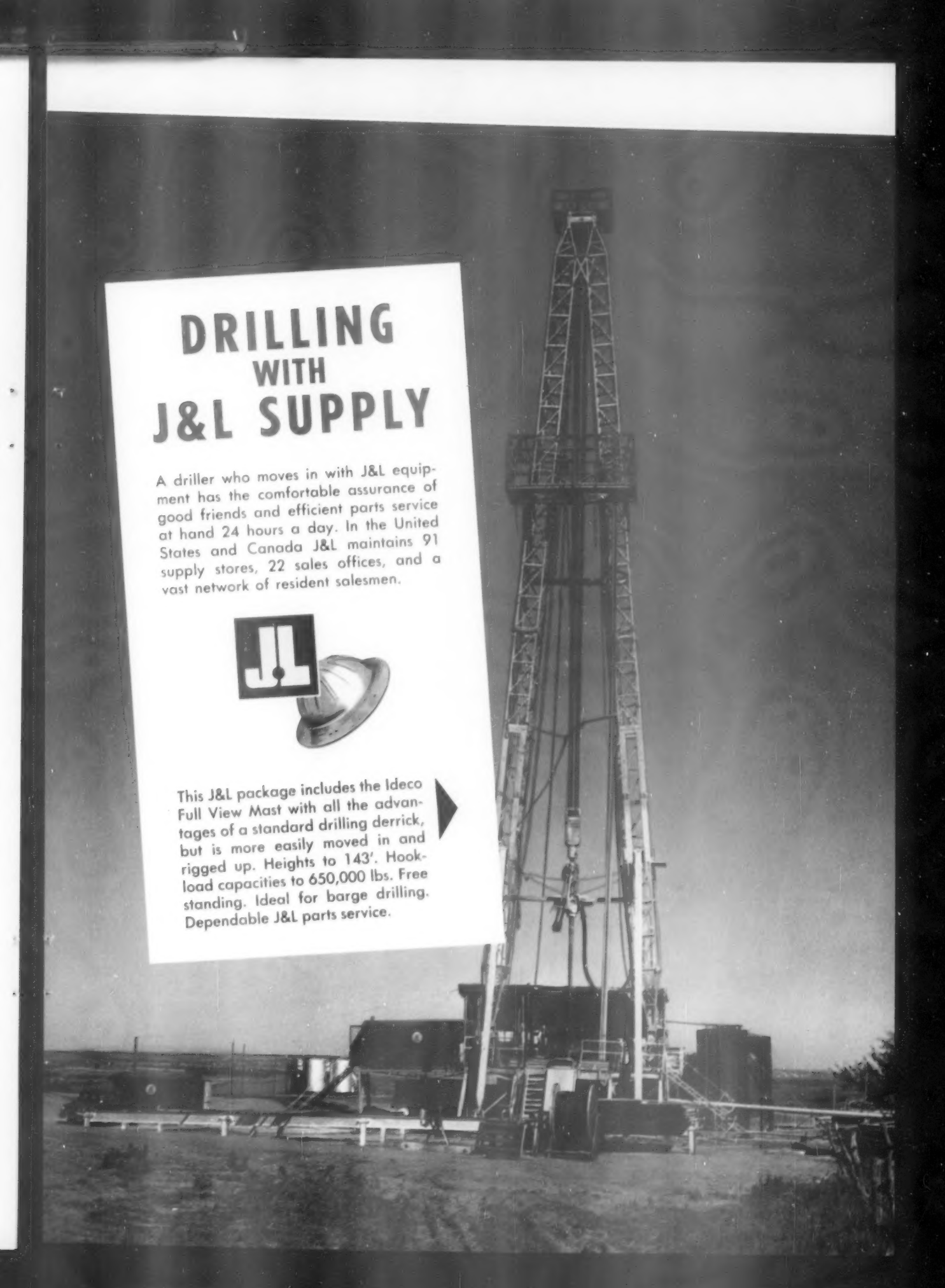
Rated 660 hp at 300 rpm each, four 6-cylinder Cooper-Bessemer GMV Compressors operate in a major oil company's $15,000,000 petrochemical plant in Pennsylvania. They maintain a continuous supply of hydrogen needed to produce benzene, toulene, and high octane motor fuel.

Keeping each of these compressors running at peak operating efficiency is a Ross Exchanger. Properly cooled lube oil is supplied to vital parts at all times.

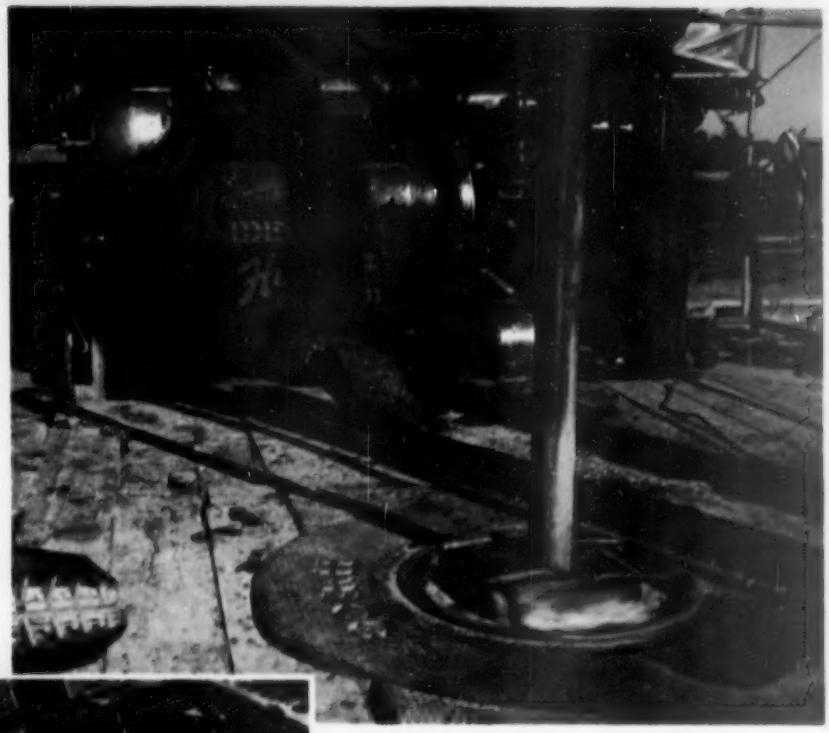
Because of their high thermal efficiency and extreme ruggedness, Ross Exchangers are given wide preference by manufacturers of numerous types and makes of machinery serving the refining and petrochemical industries: compressors, turbines, engines, blowers, reduction gears, centrifugal pumps, torque converters and fluid drives. Compact in design, these adaptable units are furnished with convenient, accessible connections for easy installation. Pre-engineered and fully standardized, they're available in a wide range of sizes to meet your needs.

For detailed information, write for Bulletin 2.1K5. Ross Heat Exchanger Division of American-Standard, 1419 West Avenue, Buffalo 13, N. Y. In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

ROSS | ROSS HEAT EXCHANGER PRODUCTS


DRILLING
WITH
J&L SUPPLY
A driller who moves in with J&L equipment has the comfortable assurance of good friends and efficient parts service at hand 24 hours a day. In the United States and Canada J&L maintains 91 supply stores, 22 sales offices, and a vast network of resident salesmen.
J&L
This J&L package includes the Ideco Full View Mast with all the advantages of a standard drilling derrick, but is more easily moved in and rigged up. Heights to 143'. Hookload capacities to 650,000 lbs. Free standing. Ideal for barge drilling. Dependable J&L parts service.

Ideco is the world's most wanted drilling equipment. Highly perfected Power or Hydrair Rigs and Streamlined Rotaries place the driller in complete command of his operations. One-third of all rotary tables in use are Ideco. Table openings from 14½" to 27½"; dead load capacities from 75 to 300 tons. Rig capacities (4½" drill pipe) to 20,000'.

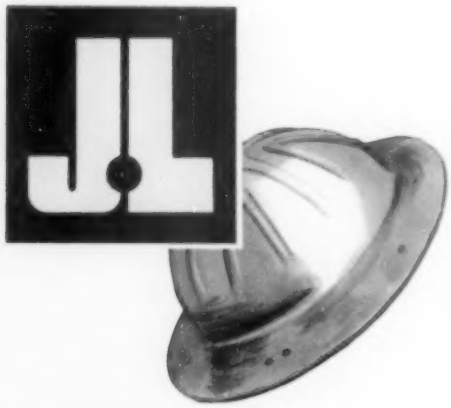


Ideco Shorty Block, Ideco Streamlined Swivel, Republic Rotary Hose — a fast, dependable trio.

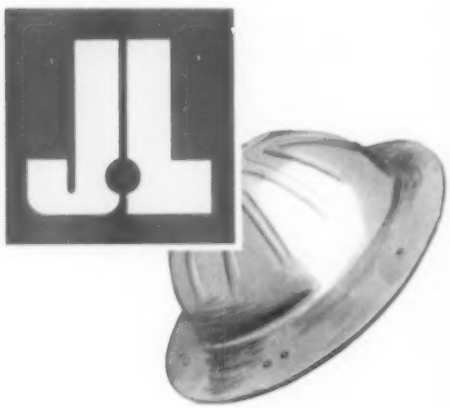
The Ideco Shorty Block unitized with hook reduces over-all length by as much as 9 feet. The sheaves ("Fabriform") are a unique Ideco development for yielding added ton-miles to the life of your wire rope. Shorty Block rated capacities to 400 tons.

Ideco Streamlined Swivels with rated dead load capacities to 300 tons. Drillers commonly complete four or five wells before replacing washpipe or packing in an Ideco — a one-man job, with about 20 or 25 minutes down-time.

Republic Rotary Hose has a patented connection drillers like — the higher the pressure the tighter the seal.



J&L Blue Ribbon Drill Pipe has to its credit the world's deepest holes. It gives a crew confidence that makes for faster, safer drilling. Made to exceptionally rigid standards, internal or external upset, from Blue Ribbon Heat-Treated Alloy Steel or Blue Ribbon plus Vanadium Heat-Treated Alloy Steel. Available in Integral-Joint with A. P. I. Tool Joint Threads, or upset for tool joint application.



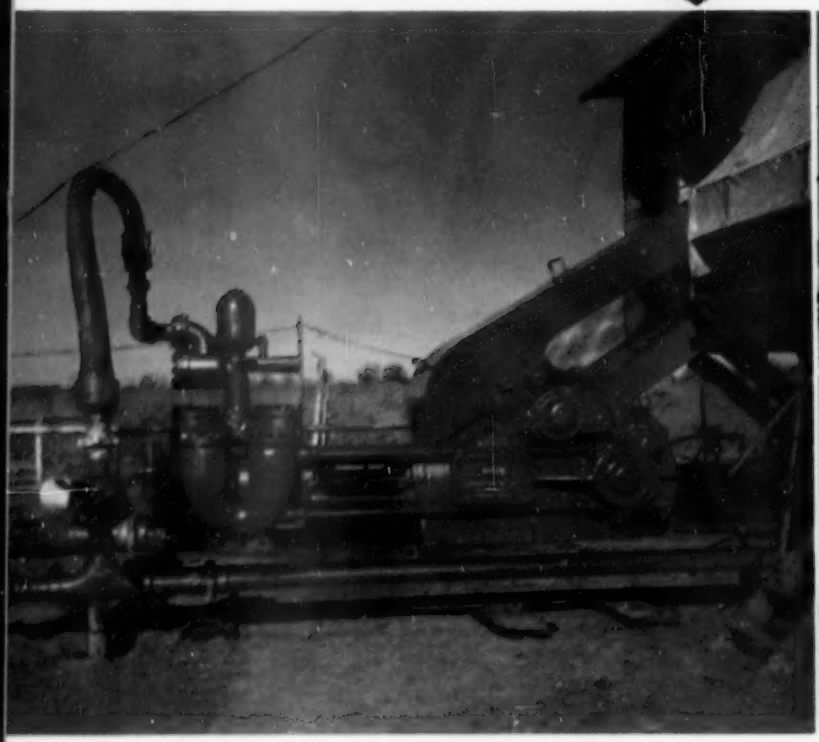
J&L Wire Rope also holds the world's records for deep drilling.

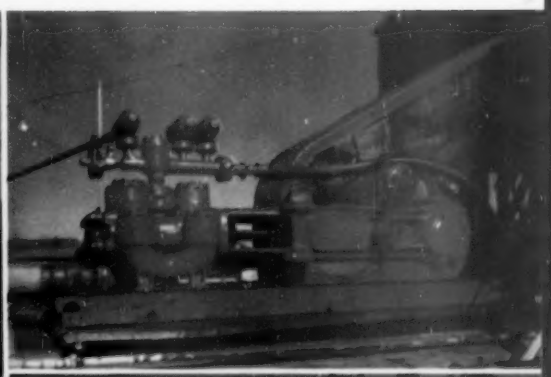
Your choice of Independent Wire Rope Center or SpringKore for rotary drilling. J&L SpringKore Rotary Line has a tightly coiled steel spring core. Flexible, but made to resist crushing, and holds more lubricant.

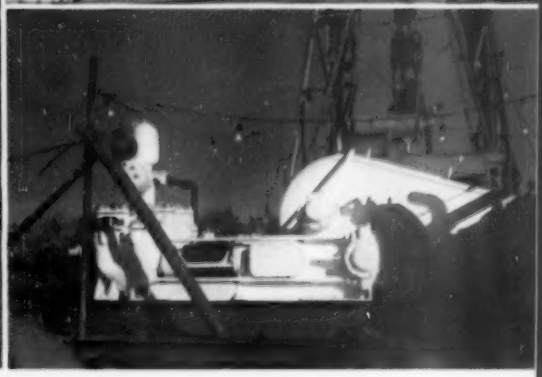
For cable tool work your choice of PlastiKore or Fiber core lines. PlastiKore is impervious to acids, caustics, and other underground destructive fluids.

J&L

This pump delivers the mud! It's the Wheland Duplex in three sizes, compact and comparatively light, but tough as a rhino. Highly accessible — and you get 24-hour J&L parts service. Left, the 350 Horsepower HP-14,000 7½" x 14". Upper right, the 750 Horsepower HP-18,000 7¾" x 18". Lower right, the 220 Horsepower HP-8,000 7¼" x 12".







To Drillers everywhere J&L deals a winning hand—
Equipment, Parts, Quality, Service, Appreciation.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

Case No. 64

Kemp Dryer
Assures Accuracy
For Sun Oil Co.

How SUNOCO®

guarantees dependable instrument readings 24 hours a day

WHEN the Sunoco Plant at Marcus Hook, Pa., introduced a new process at the beginning of the year, many new instruments were installed. To dry the compressed air operating these instruments and assure accurate readings, Sunoco installed a Kemp Model 300 S Dryer

Kemp Dryer Entirely Satisfactory

According to Harold Powers, Instrument Supervisor at Sunoco, the Kemp Dryer has been entirely satisfactory in performance. Operating continuously day and night since installation, it has performed according to specifications, has never been saturated, and has required very little attention.

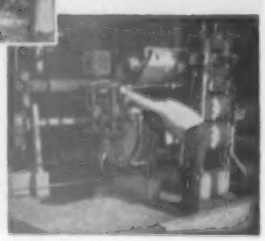
Kemp Dryers for Every Purpose

Kemp offers a variety of dryer models to meet all problems. Designed to dry air to sub-zero dew points at low cost, they are constructed of quality materials and embody the engineering knowledge gained from Kemp's many years of experience. They are available with manual, semi-automatic, or fully automatic tower reactivation. In addition, Kemp will prescribe the proper desiccant for each specific drying job. If you have a problem involving the removal of water from air, gases, or liquids, contact Kemp engineers now.

KEMP INERT GAS GENERATORS, too, serve Sunoco well

Sunoco reports that its two Kemp Inert Gas Generators have given highly satisfactory service. They are easy to start, and then operate automatically, requiring little attention. Both deliver high volume of gas of the proper analysis regardless of demand.

Kemp Inert Gas Generator Model C-5 MIHE. Delivers N_2 and CO_2 used to blanket top of wax tank.



Kemp Inert Gas Generator Model B MIHE. Produces N_2 and CO_2 for blanketing and for bubbler systems. Located in the open.

For more complete facts and technical information, write for Bulletin D-27 to:
THE C. M. KEMP MFG. CO., 405 East Oliver Street, Baltimore 2, Md.

KEMP OF BALTIMORE

DYNAMIC DRYERS

CARBURETORS • BURNERS • FIRE CHECKS
METAL MELTING UNITS • INERT GAS GENERATORS
BINDERY EQUIPMENT

WHEN YOU NEED IT!

Nearby stocks of the right rope are vital to you pipeline contractors "en route."

That's what you have in Yellow Strand—a nation-wide network of distributors and warehouses ready to serve your needs. Their specialists *know* what you need.

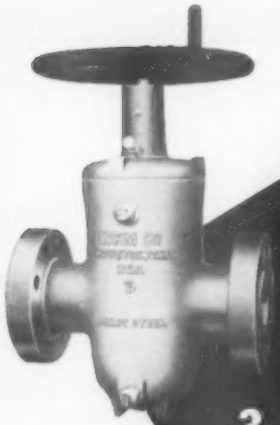
Then, of course, you get highest quality steels, long wear, many years of manufacturing "know-how."

Yellow Strand adds up to complete satisfaction—call for it at your nearby Yellow Strand dealer.

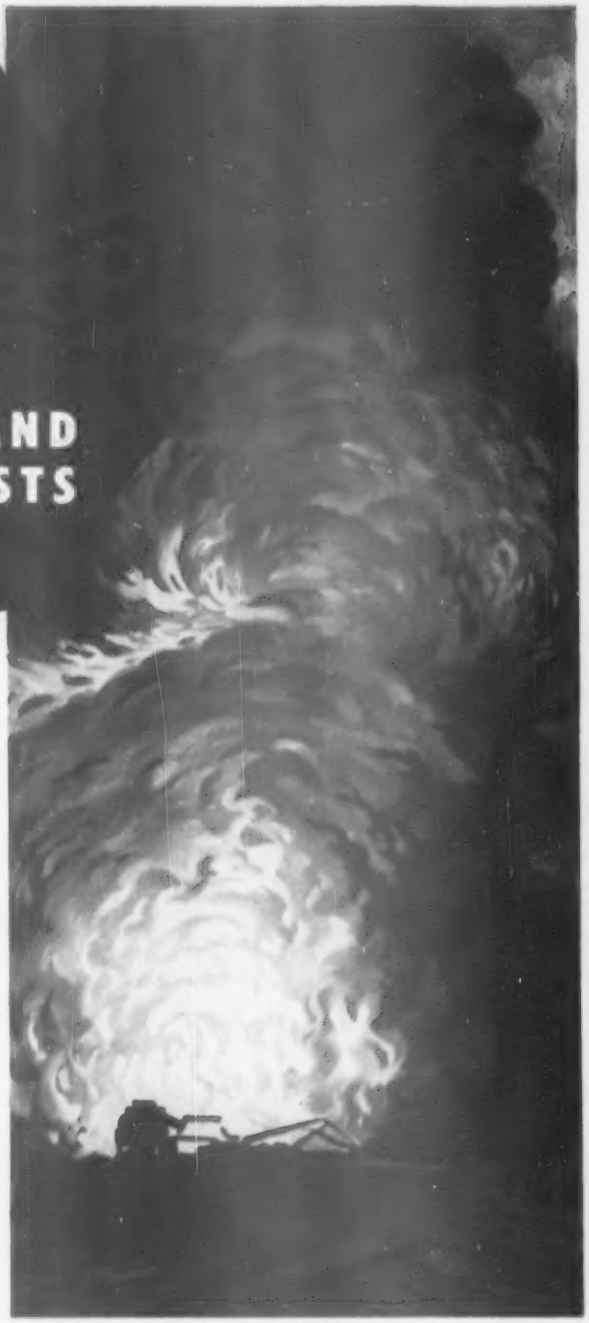
BRODERICK & BASCOM ROPE CO.
4203 Union Blvd. • St. Louis 15, Mo.

Yellow Strand
WIRE ROPE

FOR SAVINGS...SAFETY...SERVICE — SPECIFY...



W-K-M VALVE SURVIVES 3 DAY FIRE AND 3 NITRO BLASTS



When the roaring blaze of this burning gas well was finally snuffed out, workers went in to close the casing wing valve.

"The valve closed and sealed perfectly," said the production engineer for one of the well's three operators. "By shutting off one of the two streams of gas it made the job of closing in the well a lot safer and easier."

It was a W-K-M 2" series, 1500 Model L Valve. For 3 days it had been subjected to the intense heat of flames which had shot as high as 90 feet. It was jarred by three nitro blasts, which shook the earth as much as two miles away and scattered debris for more than a mile.

Only the metal-to-metal seals of the W-K-M Valve could withstand such an ordeal. Only the tolerances allowed by the parallel expanding gate could permit free movement after three days of intensive heat. Only the strength provided by the W-K-M design could survive the jarring impact of the nitro blasts.

You may never have a fire — but you should have assurance that the valves you use provide the greatest possible safety factor in any emergency. W-K-M is such a valve. Ask your W-K-M Representative.

5607

W-K-M MANUFACTURING COMPANY, INC.
A SUBSIDIARY OF ACF INDUSTRIES INCORPORATED
PLANT: MISSOURI CITY, TEXAS • MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

MANUFACTURING

W-K-M THROUGH-CONDUIT GATE VALVES

ACF LUBRICATED PLUG VALVES

KEY RETURN BENDS AND FITTINGS

Johnston is tops in testing

and here's why

This is the day of specialization, and Johnston's specialty is obtaining for you the most accurate formation data possible, short of making a permanent completion. Our every effort is to improve the mechanical design of our instruments and make our field service organization more valuable to you.

Johnston has the advantage of experience, too . . . experience dating from 1927. Founded on Drill Stem Testing, the Johnston organization has grown by excelling year after year in this important service.

Johnston equipment and methods are backed by the most extensive engineering research group in the field of subsurface testing. Tangible evidence of this is the exclusive Johnston Tension Type Pressure Recorder which is so sensitive it faithfully records pressure changes of as little as 5/100 of 1 per cent. A built-in thermometer and extra inches of deflection in the tension member (which also has an extremely low thermal coefficient), combine to make this by far the most consistently accurate formation pressure recorder.

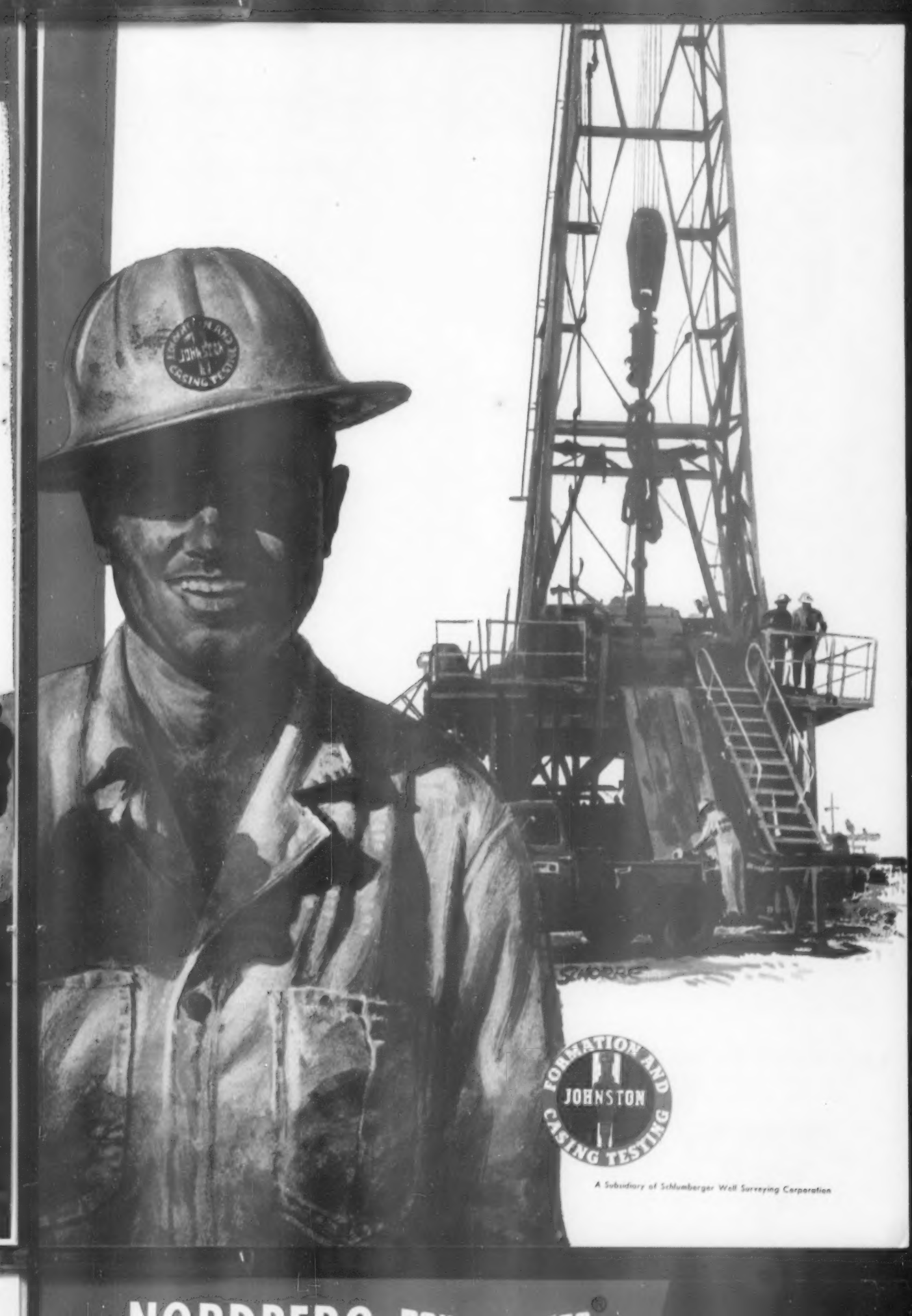
JOHNSTON TESTERS

first in drill stem testing

P. O. BOX 98,

HOUSTON, TEXAS

LOS ANGELES, CALIF. • CALGARY, CAN.



FORMATION AND
JOHNSTON
CASING TESTING

A Subsidiary of Schlumberger Well Surveying Corporation

CPC
PERMETER SERVICES

Whether you are bringing in a new completion or working over an old well, our special Permeter Services will help you get better, more profitable production. The Permeter is a modern, scientific field facility that will furnish information for efficient completion and workovers, and also help to do the well service work. We would welcome the opportunity to describe these three services to you more fully, recommend whether they have an application to your wells, and give you illustrated literature without obligation.

Permeability Meter Surveys

— a reliable, accurate method of metering the flow of fluids in the well bore — afford detailed, permanent logs of the exposed zones of permeability, and the comparative permeability of each zone. The logs are obtained by electrical signals transmitted from the survey tool which is run into the well on an Amergraph line. Permeability surveys can also be made to locate casing leaks, detect leaks around a casing shoe or bottom hole plug, or to detect zones of lost circulation.

Open Hole Caliper Surveys

are a quick and economical method of obtaining important well data prior to any remedial work. The CPC Caliper is small enough to be run through open end 2" tubing, and the motor-driven feeler arms can be extended or retracted at will for repeated runs within a short time without coming out of the hole. Surface equipment plots a permanent graph which can be used for comparison with permeability surveys, radioactivity logs, etc.

Controlled Acid Treatments

allow "selective" acidizing of two or more zones in the open sections of a well. A CPC Permeter Control Nipple, made up in the tubing, and an electrode tool, run in on a conductor line, are used to determine the acid-oil interface during acidizing treatments. Acid can be diverted into the formation either above or below the control nipple for treating each zone as desired.

THE CHEMICAL PROCESS COMPANY

General Offices in Breckenridge, Texas

THE CHEMICAL PROCESS CO.
SERVICING OIL & GAS WELLS

▼ Breckenridge • Abilene • Big Lake
▼ Borger • Fort Worth • Graham • Levelland
▼ Luling • Midland • Odessa • Pearsall
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▼ Wichita Falls • Shreveport • Hobbs • Enid
▼ Guymon • Oklahoma City • Pauls Valley
▼ Seminole • Tulsa • Great Bend • Hill City
▼ Hugoton • Lakin • Russell • Wichita

They Say—

Surrender on Imports

"In the absence of any sound policy as to oil imports, we have seen foreign oil take an ever-increasing and unjustified share of the domestic market. We have had study after study by Government indicating a need to restrict imports to a supplementary level. Despite these almost endless efforts, a solution, somehow, failed to materialize . . .

"By exceptions, Dr. Flemming has actually excused from any control at all more than 75 per cent of the total imports now coming into the United States. It amounts to nothing more than a complete surrender."

Rep. Frank Ikard of Texas in speech before U. S. House of Representatives.

Base Depletion on Replacement Costs

"It is becoming increasingly important that the petroleum industry meet the problem of replacement costs by taking immediate steps to obtain through proper authorities in the accounting, engineering, and economics professions, and the federal and state governments, recognition of the replacement principle as it may be applied in all matters directly related to the oil and gas industries.

"Industry needs realistic depletion and depreciation . . . Business profits are overstated which base depletion and depreciation charges on original costs rather than replacement costs . . .

"Frequently the financial reports of oil companies . . . are cited by those who repeatedly attack the petroleum industry as evidence of unwarranted profits and tax avoidances.

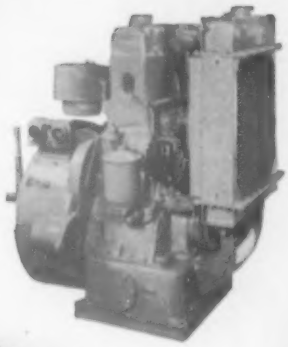
"Petroleum industry management has repeatedly warned its stockholders in recent years that, insofar as all-time records of earnings come from crude product sales, the industry is in effect selling off its shelves goods which cannot be replaced at anything like the original cost. . . .

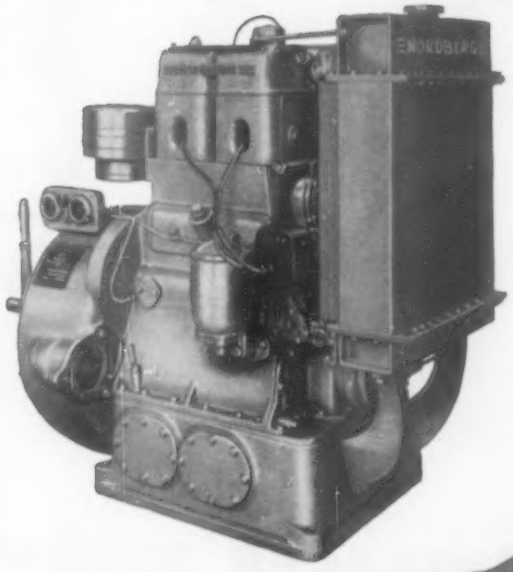
"There is growing recognition of the need for additional statistical and factual data with respect to replacement costs. Traditional accounting methods for computing depletion and depreciation on cost do not reflect the currently higher replacement costs of acquiring and equipping oil properties.

"The accumulated reserves created each year through accounting charges for depletion and depreciation are woefully inadequate to do the job of providing the funds for replacing oil re-

NORDBERG POWER CHIEF®
OILFIELD PUMPING ENGINES

...now available in
SINGLE-CYLINDER...





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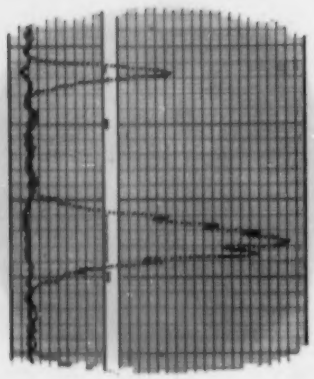
Get the Full Picture

OF YOUR OIL WELL

with Welex R/A TRACER SERVICE



Know exactly what's happening during your water-flooding or fracturing operation . . . use the Welex radioactive tracer service.

You can definitely locate the permeable zones following a fracture treatment . . . check the zones taking water in a water-flood well . . . evaluate squeeze cementing operations and locate tops of cement. Your Welex R/A Tracer log will be clear, definite, easily interpreted . . . you'll end guesswork . . . and insure a better well.

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serves currently consumed and equipment which has worn out.

"There is need for a better understanding of the economic concept of replacement costs as compared with bookkeeping practices. Book costs are often cited to prove the profitability of crude producing operations, while actual, or current, costs are ignored. The accounting concept of depletion and depreciation as recorded in book costs is simply the writing off of fixed assets over the life of the property. The economic concept is that the return of capital value through depletion and depreciation will permit the replacement of assets used up or worn out."

James V. Brown, secretary-treasurer of the National Petroleum Council, in address before 33rd annual meeting of Pennsylvanian Grade Crude Oil Association, Bradford, Pa.

Unit Approach Lauded

Dear Sir:

I was overwhelmed when I saw the results of excellent professional talent which has been applied to the meager idea that was submitted to you concerning the Unit Approach. I am sure that all members of both the steering and legal committees join me in expressing gratitude for the ultimate favorable reception that can be anticipated because of your generous efforts in making our work known to the industry.

John H. Folks
Division Landman
Carter Oil Co.
Oklahoma City, Okla.

Communistic Tax Line

"The terms 'allowance' and 'subsidy' applied to depletion, deliberately adopted as weapons of attack by former New Deal professors, are false and can only proceed from a communistic attitude that everything belongs to the Government and by allowing one to keep his own property it thereby subsidizes him.

"Typical of the arguments is Professor Gray's parroting . . . that 'three-fourths of the total benefit accrues to large corporations.' This ignores the fact it really accrues to their hundreds of thousands of stockholders, including widows and orphans and our large insurance companies, in which almost every American family has a stake, as well as all our leading privately financed colleges who own thousands of shares in these companies.

"If depletion were a bonanza, oil companies would have earned much more than other companies, but it appears they did not. Eight wildcat wells in nine are dry. The domestic oil com-

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Representatives in All Major Producing Areas

panies at present rate of consumption have on the average only enough reserves to last less than 14 years. Consumption is annually increasing and if they are not encouraged and stimulated to discover more oil, what will happen to our present mode of life with its great dependence on oil?"

John E. Hughes, Chicago tax attorney, in letter placed in Congressional Record by Rep. Marguerite Stitt Church of Illinois.

Keep Canada Canadian

"There is no use dodging the issue (alien control of the Canadian oil industry) any longer. The extent to which United States control of various vital aspects of the Canadian economy has grown in the past 10 years or so is positively frightening. Oil, iron ore, aluminum, natural gas, manufacturing. Where is it going to end?

"Unless something is done to halt this trend, and to remove it, it is going to end with the virtual disappearance of Canada as a nation worth the name."

Editorial in the Calgary Herald.

Drilling Methods Are Outmoded

"Oil well drillers are working with equipment and using methods that should be outdated in this modern age . . .

"We have cut drilling costs about as far as possible. The next step will be to try to cut costs of the hardware that goes into the well."

W. F. Bates, assistant to the Pacific Coast area vice president of Shell Oil Co., at the annual meeting of the Nomad Club, Los Angeles.

"Sold" on England

"We are pretty well sold on the idea that England is a good investment.

"We are much concerned about the political situation in the Middle East, but from our studies we don't feel the oil assets of the Middle East are in jeopardy."

Munroe Rathbone, president, Standard Oil Co. (N. J.), in press interview on sailing for Europe to study company expansion plans in England.

CALENDAR OF EVENTS

JULY

9-11 American Gas Association, American Petroleum Institute, Canadian Petroleum Association, committees on natural gas reserves, Banff, Alta.

17-27 Program on Recent Advances in

Catalytic Polymerization, Massachusetts Institute of Technology, Cambridge, Mass.

18-20 Yellowstone-Bighorn Research Association, third Professional Short Course on Uranium Occurrence and Structural Geology, Red Lodge, Mont.

AUGUST

2-4 Rocky Mountain Mineral Law Foundation, Second Annual Institute, University of Colorado, Boulder.

20-21 North Dakota Oil and Gas Association, annual meeting, Bismarck, N. D.

27-29 Sixteenth Annual Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

SEPTEMBER

5-7 Wyoming Geological Association, eleventh annual field conference, Jackson Lake Lodge, Moran, Wyo.

9-12 Independent Natural Gas Association of America, annual membership meeting, St. Anthony Hotel, San Antonio, Tex.

11-13 Pacific Coast Gas Association, annual meeting, Coronado, Calif.

12-14 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

13-15 Chemical Institute of Canada, third Western Regional Conference, Edmonton, Alta.

16-18 New Mexico Petroleum Industries Committee, annual convention, Hilton Hotel, Albuquerque.

16-21 American Chemical Society, 130th annual meeting, Atlantic City, N. J.

16-21 American Society for Testing Materials, Second Pacific Area National Meeting, Statler Hotel, Los Angeles.

17-21 Instrument Society of America, eleventh annual international instrument-automation conference and exhibit, New Coliseum, New York City.

20-21 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Hotel Henning, Casper, Wyo.

20-21 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual membership meeting, Roosevelt Hotel, New Orleans.

24-26 American Society of Mechanical Engineers, petroleum mechanical engineering conference, annual meeting, Statler-Hilton Hotel, Dallas.

26-28 Rocky Mountain Mineral conference, American Institute of Mining, Metallurgical & Petroleum Engineers, Newhouse Hotel, Salt Lake City.

OCTOBER

2-3 Texas Mid-Continent Oil and Gas Association, thirty-seventh annual meeting, Rice Hotel, Houston.

2-4 National Association of Corrosion Engineers, south central region, Beaumont.

7-9 American Association of Oil Well Drilling Contractors, annual meeting, Texas Hotel, Fort Worth.

11-12 California Natural Gasoline Association, fall meeting, Sheraton Hintington Hotel, Pasadena, Calif.

14-17 American Institute of Mining, Metallurgical & Petroleum Engineers, Petroleum Branch, fall meeting, Biltmore Hotel, Los Angeles.

14-20 OIL PROGRESS WEEK.

15-17 American Gas Association, annual meeting, Atlantic City, N. J.

18-19 Western Petroleum Refiners Association, regional technical-industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

18-21 Permian Basin Oil Show, Odessa, Tex.

22-24 Rocky Mountain Oil and Gas Association, annual convention, Cosmopolitan Hotel, Denver.

29-30 Illinois Geological Survey, Petroleum Engineering Conference on Waterflooding, University of Illinois, Urbana, Ill.

29-Nov. 1 Society of Exploration Geophysicists, annual meeting, Roosevelt Hotel, New Orleans.

NOVEMBER

7-8 Philadelphia section, Instrument Society of America, Symposium on Process Data Logging, Stratford Hotel, Philadelphia.

8-9 American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Economic Paleontologists and Mineralogists, Pacific Coast Joint Regional Meeting, Ambassador Hotel, Los Angeles.

12-15 American Petroleum Institute, annual convention, Conrad Hilton Hotel, Chicago.

19-20 American Institute of Mining, Metallurgical & Petroleum Engineers, North Texas Secondary Recovery Symposium, Municipal Auditorium, Wichita Falls.

25-30 American Society of Mechanical Engineers, Statler Hotel, New York.

JANUARY (1957)

14-16 Pipe Line Contractors Association, ninth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

"SOMEBODY HAS TO PAY FOR IT — UNLESS IT SHOWS UP IN THE SHAKEOUT."

"Mr. Oil Man, are you getting true tests on your oil? Are you paying for oil you don't get? Are impurities taking part of your allowable? Are you paying the expense of handling impurities? Are your samples being shaken out at the proper speed, and are they at the proper temperature at the end of the shakeout?

"Test your good or bad oil the usual way, and then test it with the Melton Heating Centrifuge. The results of the Melton test will really surprise you."

One major oil company found enough difference in one tank of oil to pay for one Melton Heating Centrifuge. Another company estimates it found a difference of 19% in testing one "tank bottom." We know that we can save you money. Don't wait. The Melton Heating Centrifuge can pay for itself many times by giving you a true test on the oil you handle. Find out now by ordering one or more.

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Patent Pending
Model B-2 (6 Volt)

They heat oil samples maintaining heat before and during rotation, obtaining a true test. Now being used by twenty-six oil companies in the United States, Canada and South America.

Fully guaranteed against failure of any part of the entire unit for one year from date of purchase.

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Model A-4-6 for 6 volt batteries
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Model A-2-6-S for 6 volt batteries
Model A-4-6-S for 6 volt batteries
Model A-2-12-S for 12 volt batteries
Model A-4-12-S for 12 volt batteries
Model B-2-6-S for 6 volt batteries
Model B-2-12-S for 12 volt batteries

Patent Pending
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1. Side plates are of abrasion resistant high strength steel, securely fused to moldboard and box sections by low-hydrogen welding. They prevent load spillage, allow you to carry larger loads. Standard on all International bulldozer blades.

2. Push arms are sturdily constructed of box sections. Side plates are mill-rolled with integral back-up bars to support top and bottom plates. Machine welding guarantees uniformity of weld.

3. Headless pins, locked by eye bolts, secure struts to blade. For removal, pins can be driven out in either direction. On hydraulic blades, all control linkage is connected to the blade through self-aligning bearings.

4. Entire perimeter of blade is backed by heavy box channels solidly fused to moldboard. With this type of construction moldboard, box channels, and welds flex freely to prevent weld failure.

5. Spillboard is wide and high to prevent spillage over top of blade. Note that it is curved to match the contour of the moldboard, thus aiding boiling action. Width of moldboard allows you to carry full load for which the blade was intended.

6. Moldboard is formed from a single sheet of low-alloy, high-strength steel. International blade is shaped to perfect curvature in a special forming machine to assure uniform strength and stress resistance over entire area.

7. Shear bars welded to moldboard support end bits and relieve stress on end bit bolts. Lower edge of end plate is reinforced by wear plate to add strength at corners, increase wear resistance.

New blades designed from "ground" up

To make full use of the greater work capacity of the new Bonus-Powered International crawler tractors, we now offer a complete line of newly designed blades matched to tractor power.

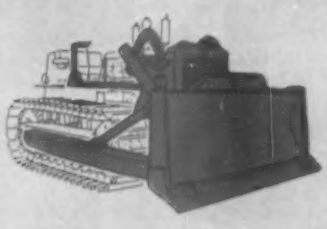
These new blades are rigidly supported around the edges by box sections to give the blade strength but also permit the moldboard to "breathe" under load stresses. New automatic welding processes guarantee that the welds in International blades will hold up under *any kind of job conditions.*

International blades will last far longer and give you far less trouble than any others you have ever hung on any tractor. When you inquire about the new line of Bonus-Powered International crawler tractors, ask your International Industrial Power Distributor for all the facts about the new line of matching blades. See for yourself that they are the best designed, best constructed on the market.

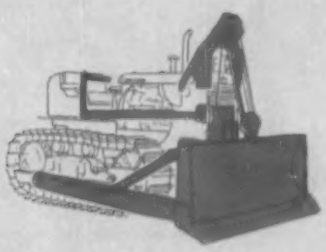
Write For New Blade Literature: An illustrated specification list of the *228* attachments available for International crawler tractors is just off the presses. For your free copy of Mailing Folder CR-492-F, write Consumer Relations Department, International Harvester Company, 180 North Michigan Avenue, Chicago 1, Illinois. No obligation, of course.

. . 42 new blades

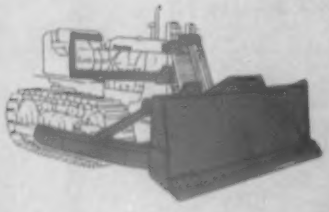
. . *Bonus-Powered* International crawlers



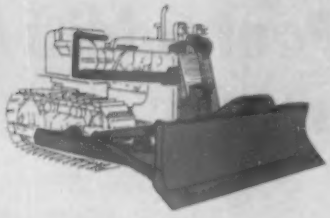
Direct Lift Hydraulic Bulldozer
Operates off front-mounted, gear-driven pump which gives fast blade action. Self-aligning bearings prevent binding of linkage.



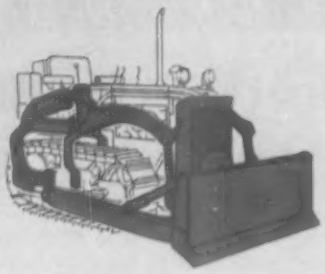
High-Gantry Cable Bulldozer
Operates off either front or rear-mounted International cable control unit. Available for TD-24, TD-18, and TD-14 tractors.



Low-Gantry Cable Bulldozer
Operates off either front or rear-mounted International cable control units. Available for TD-24, TD-18, and TD-14 tractors.



Hydraulic or Cable Bullgrader
Operates off high or low gantry, front or rear cable controls on TD-24, TD-18, and TD-14 tractors. Hydraulic bullgrader also for TD-9, TD-6, and T-6 tractors.



Track Frame Mounted Bulldozer—Distributes the load evenly over the length of the tracks. Available only for TD-9, TD-6, and T-6 tractors. Bullgrader also available.

International Drott "4-in-1"
Newest of International Drott loaders. Combines Skid-Shovel, Bull-clam, clamshell, and bulldozer in one unit. Available for TD-14, TD-9, and TD-6 tractors.

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Du Pont Antioxidant No. 22	$2,250	6.7%	$2,250	6.7%	$2,400	7.0%
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Shown above are nine typical situations—three locations, three additives. They illustrate how substantial sums can be saved when you order Du Pont additives in 4,000-gallon tank-car lots. The saving is over the costs of the same quantities in less than carload lots, in drums. The total savings shown reflect lower product cost and lower freight rates.

Four-figure savings are yours each time you order a Du Pont additive by the tank car

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For example . . .

The above chart shows how refiners in three areas can save from $1,680 to $2,400 simply by ordering a Du Pont additive by the 4,000-gallon tank car instead of equal quantities in partial car shipments in drums. These figures are, of course, based on the freight rates for only three locations; savings will vary somewhat for other receiving points. However, the saving will be decidedly worthwhile anywhere . . . for any one or more of the products listed.

How much can you save?

To answer that question for you, one of our nearby representatives will be glad to call at your refinery, study your freight rates and inventory patterns. He will then determine the most convenient handling method for you and figure the exact saving you can make. Phone, write, or wire us . . . today.

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TULSA, OKLAHOMA

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JOURNALLY SPEAKING . . .

Regina Revisited

IN the book "Confessions of an Oil Reporter," which we intend to write sometime, we shall have to devote considerable space to the personal pleasures and professional benefits derived from junketing and free-loading with oil men whose purse strings and expense accounts are of more ample proportions than those of a mere pencil pusher.

The assumption that someone else will pick up the tab has long been one of the privileges and prerogatives of the Fourth Estate, but those members of this peripatetic profession who have the good fortune to follow the far-flung perigrinations of oil operators are particularly favored. We get some swell junkets.

Thus it was due to the generosity of oil men (who asked no special publicity in return for their hospitality and largess) that we have twice within 2 years had the opportunity to visit Regina, the Queen City of Saskatchewan.

If Alberta is the Texas of Canada, Saskatchewan is surely its Kansas. Only it is more like Kansas than Kansas in its flatness, its treelessness, its windiness, and the vastness of its wheat-filled landscape broken only by an occasional grain elevator on the skyline.

In the midst of this featureless plain lies the verdant and jeweled oasis of Regina, a lively metropolis of some 80,000 people, now burgeoning from an influx of oil men from the States.

In most superficial aspects, Regina is exactly like any other town on the Great Plains between the Gulf of Mexico and the Arctic Ocean. But there are differences that give Regina a uniqueness. One is the wonder that it is there at all in the midst of the surrounding nothingness. From the air it looms like an atoll in the South Pacific. From the upper window of the hotel it appears closely clustered as though for companionship and protection, and beyond the edge of town stretches the limitless—the incredibly flat and limitless—prairie.

Everything in Regina was got the hard way. Every one of the thousands of trees that line the streets and fill the yards and parks was planted and nurtured by loving hands. Even the charming lake that half-encircles the classical provincial Capitol was—literally—made by hand. The lack of local timber or other construction materials is reflected in the austerity of much of the architecture. Houses huddle close together, not for lack of space, but because of the expense of burying sewers and water mains 12 ft. deep to get below the frost line.

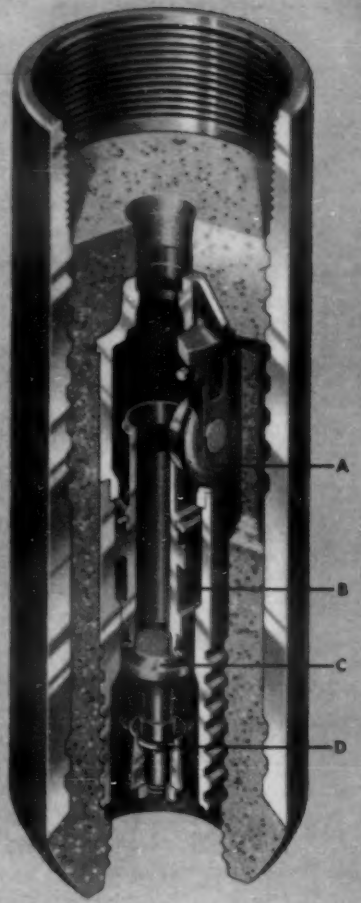
Possibly as a reaction to the bleakness and isolation of their locale, the people of Regina have an unusual warmth and friendliness, and their hospitality is a happy blend of midwestern openness and British politeness.

Not the least of their tokens of hospitality is a liquid they skillfully extract from the fruit of the rye, most notably a particular variety that comes in a crown-shaped container encased in robe of royal purple. It makes the cup that cheers but never—well, hardly ever—inebriates. Nowhere, in our experience, can this rare nectar be found save in Regina. It alone made our return visit memorable.

We have great difficulty convincing our Front Office that junketing and partying are strictly business. But the plain truth is that an oil reporter can pick up his best dope while associating with oil men in a relaxed mood, such as when they are playing the host with a sirloin steak or a long, cool glass. So, strictly in line of duty, we bravely tear ourselves away from home and family and run the risk of stomach ulcers and airplane crashes to accept any and all invitations to be a free-loader on any sort of an expedition of oil men, to Regina or any place.

In the process we do manage to get an occasional tidbit for our favorite oil publication. And travel has broadened us through acquaintance with Regina, rye juice, and other such attractive places and things. Best of all, we meet such interesting people.

—*Henry D. Ralph.*



A Flapper Type Back-Pressure Valve activated at option of operator.

B Sleeve Valve } Control rate of flow and volume of fill-up fluid.

C Sleeve Valve Seat }

D When operator shears this Shear Ring (1,000 psi on casing), Flapper Valve is released to form a Back-Pressure Valve for floating or cementing.

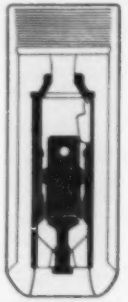
Baker DIFFERENTIAL FILL-UP Shoe
Product No. 1081

It fills casing from the bottom up

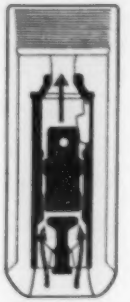
With Baker DIFFERENTIAL FILL-UP Shoes and Collars, casing is filled automatically from the bottom up, *while it is being run*... and because DIFFERENTIAL Equipment contains a Variable Valve *that opens and closes* to synchronize the rate of "fill" with the rate of lowering the casing, maximum reduction of destructive high-pressure surges is obtained.

This "controlled automatic fill" saves up to one-third of running-in time because... (a) time-wasting surface filling of casing is eliminated; and (b) casing can be run in at a faster speed, reducing the possibility of sticking, without causing destructive high-pressure surges. Pressure surges over 5000 psi can be created below casing equipped with floating equipment each time a joint is lowered. Damage caused by these high-pressure surges and the cost of this damage in bad cement jobs, lost circulation, and decreased production is becoming a matter of concern to many operators.

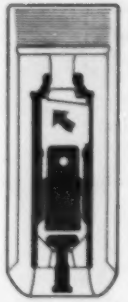
HOW DIFFERENTIAL EQUIPMENT WORKS



RUNNING-IN
Sleeve Valve in closed position



RUNNING-IN
Sleeve Valve in opened position



CEMENTING OR FLOATING
Flapper Valve released

Hydrostatic pressure of the "fill" acts on the upper pressure area of the sleeve valve. Hydrostatic pressure of the fluid in the annulus acts on the lower pressure area of the valve which is 90% of the upper pressure area. It is this differential in area that results in a "fill" of approximately 90% (shoe or collar), or 81% (shoe and collar) with respect to the fluid level of the annulus and gives the equipment its name. The valve opens and closes in accordance with the pressure differential across it to: (1) fill the casing automatically, (2) reduce pressure surges and (3) prevent overfill of the casing.

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BAKER DIFFERENTIAL Fill-Up Equipment

Cut imports, yes, but hold down here, too

THE cut in imports just requested by the Office of Defense Mobilization is too little and too late to have a stiffening effect on the price of crude oil in this country.

The crude-oil situation has been going to hell in a handbasket for the past 2 or 3 months. It could easily reach a crisis before the summer is over, even if the imports cut is fully effective.

The supply of crude so greatly exceeds the demand for it that there is slight chance of the price increase that producers feel is long overdue. Under the best possible conditions the situation could right itself sufficiently for the price to stiffen by late fall. On the other hand the situation could deteriorate enough to precipitate more cuts in postings such as those recently in Wyoming and Illinois.

IT'S EASY TO BLAME IMPORTS for this. Crude imports have increased faster than domestic production, percentagewise. But imports aren't the whole cause of the trouble, by any means. Three-fourths of the increased supply this year has come from domestic wells.

Along about last March things looked pretty good. Demand was high and supply was in a reasonably comfortable balance. Crude supply wasn't really tight, but it was better than it had been for a couple of years.

But then prorating states forgot that demand always slumps in the spring. They postponed seasonal cuts in allowables. Importers forgot it, too. After a slight decline, crude imports shot up to a new peak. Everybody gambled that his own extra barrels wouldn't break the market. All this time, demand was falling and stocks were rising.

The combination was just too much for the market to handle, and the inevitable happened. Today, except for a few specialty types, crude is in seriously long supply. Every major purchaser is hunting for storage space and trying to get somebody to take a few thousand barrels a day off his hands. Most of them insist that their own stock position is worse than the national statistics indicate—a paradox that is hard to explain but seems to exist.

Now Texas and Oklahoma have boosted their July allowables—well above purchasers' nominations and in the face of threats of pipeline proration. However plausible the reasons for this, the results will be an even sloppier market.

CUTTING IMPORTS to the new ODM request will be a partial palliative. But the situation won't be corrected unless the prorating states simultaneously curtail to actual market demand.

Domestic producing capacity is so great that even if crude imports were totally embargoed the market would be glutted if everyone produced at MER. If total supply isn't held to what the market will use, the present condition will continue indefinitely.

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Current and significant in . . .

The Industry This Week

Pipelines

• **Trans-Canada has awarded contracts** for four of seven spreads on the 574-mile western leg of its line which will bring Alberta gas to Winnipeg this winter. Firm also is completing new sales contract for delivering 100,000 M.c.f. daily to Northern Ontario Natural Gas. P. 63.

Bitter contest before FPC is in prospect over projects to carry Texas gas to Florida. P. 67.

Industry

• **American Chemical Society** may dispose of its stock ownership of Universal Oil Products Co. Trustee of fund holding stock in trust for A.C.S. wants to diversify portfolio. P. 64.

New taxes are now in effect on motor fuel, tires, trucks, etc., to pay for 41,000-mile, pay-as-you-go superhighway system. P. 70.

A 10 to 15-cent price increase in specialty crudes on the Gulf Coast and in Southwest Texas has been posted by Humble. Company, however, says general price increase not warranted at present. P. 68.

Interest is growing in free-piston engine. Texaco is starting first oil-industry research on behavior of the power unit. P. 67.

Exploration

• **Venezuela has granted** 8 of the 11 highly prized new concessions in Lake Maracaibo. Reports say the tracts brought total bonus bids of between $188 and $195 million. P. 77.

A third big Morrow producer has brightened the outlook for new oil-gas reserve in Oklahoma's Texas County. Latest well drilled by Panhandle Eastern has initial potential of 234,900 M.c.f. daily. P. 69.

Stanolind is paying a record $4¼ million for a 3,840-acre drilling block in Pecos County, West Texas. Bid was highest at lease auction held by University of Texas, which pocketed $16,437,254 in bonuses on 57,241 acres. P. 68.

Production

• **Free-world crude production** is reversing its historical pattern. Instead of dropping sharply in April, it steadied at 7,715,200 bbl. daily for a 1,400-bbl. daily gain. P. 76.

Middle East importers are being asked by ODM Director Flemming to slash their schedules for third-quarter shipments to East and Gulf coasts by 97,000 bbl. daily. P. 64.

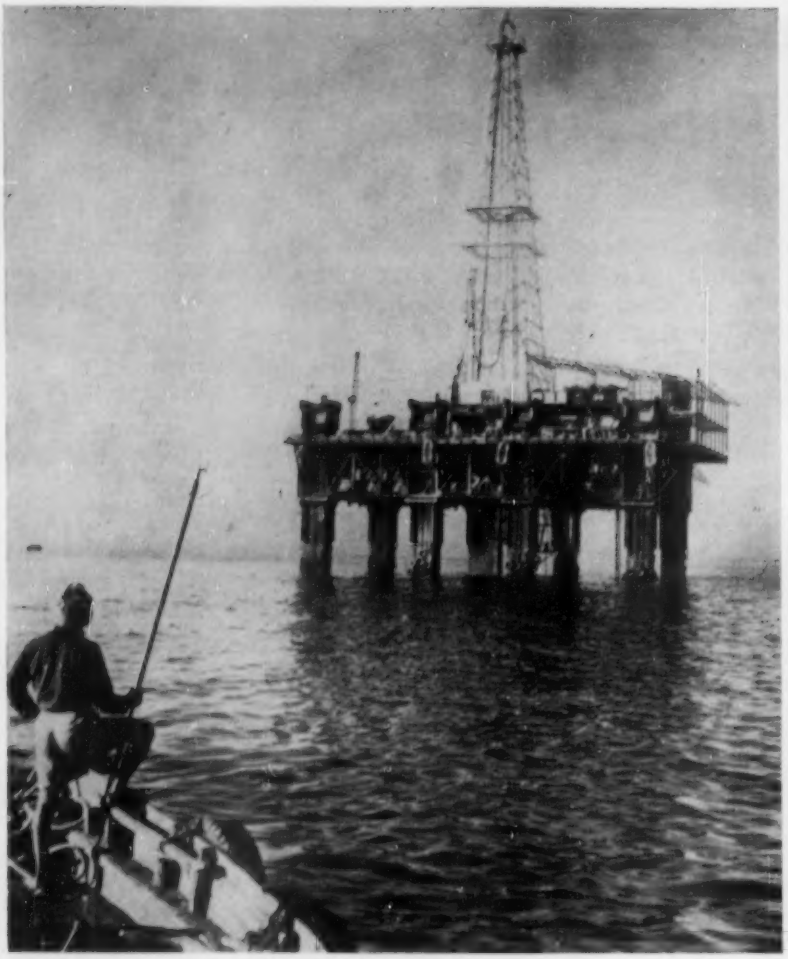
New monthly record in nominations for Alberta crude has been set. Refiners are requesting 444,385 bbl. daily during July. P. 74.

Processing

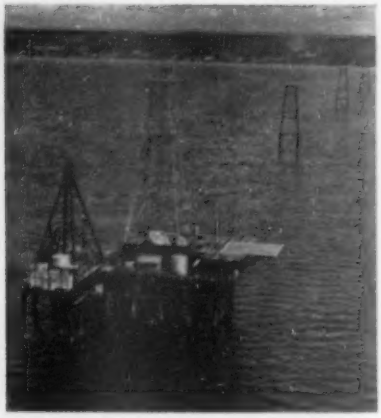
• **First tailor-made chromatograph** to be used in automatic analysis of refinery gases has been installed at Esso Standard's Bayway plant. Its advantages: Quick, accurate analysis for process control and big economy over laboratory testing. P. 66.

Another refinery in the Pacific Northwest—at Bellingham, Wash.—has Government blessing. ODM has given New England Industries, Inc., quick tax writeoffs on $14.3 million of the $18 million plant. P. 68.

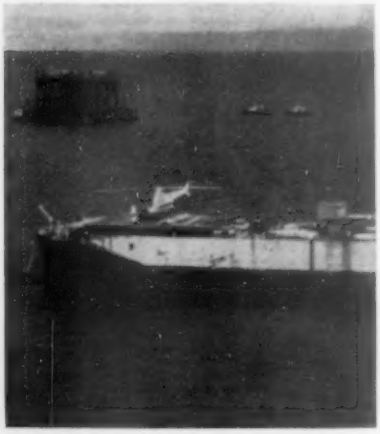
Small refiners and jobbers are fighting to keep the right to cut prices to meet competition. They told a Senate committee that House-approved restrictions on the good-faith defense will cripple them. P. 74.



OFF QATAR Shell is using this platform to search for subsea oil.



OFF BORNEO is this platform, connected to land by an aerial ropeway.



ANOTHER PLATFORM for use off Borneo is towed seaward. It's a part of a widespread oil hunt as . . .

Oil Goes to Sea Around the World

Paul Swain

THE lure of fresh crude-oil reserves has made mariners out of a good-sized segment of the oil industry in the United States. But this development by no means is confined to this country's coastal waters.

Salt spray and rough waters are becoming familiar hazards to the oil-finding fraternity the world over. The very bigness of the Gulf of Mexico oil operations in terms of money spent and number of companies involved has captured popular fancy. This has tended to obscure other marine operations scattered around the globe.

The biggest proved offshore oil field in the free world is not in the Gulf of Mexico, however. It is in the Persian Gulf. There Arabian American Oil Co.'s Safaniya field off the coast of Saudi Arabia needs only a pipeline to go on full production. It is now being built.

This search for oil beneath the world's seas ranges from geological and geophysical work to actual production in two major areas. All indications point to an increase in this type of operation. The possibilities for overwater drilling exist in a number of areas of the world that have not yet been touched.

Safaniya field . . . The work which Aramco has done in the Persian Gulf actually predates the intensive work that is now going on in the Gulf of Mexico.

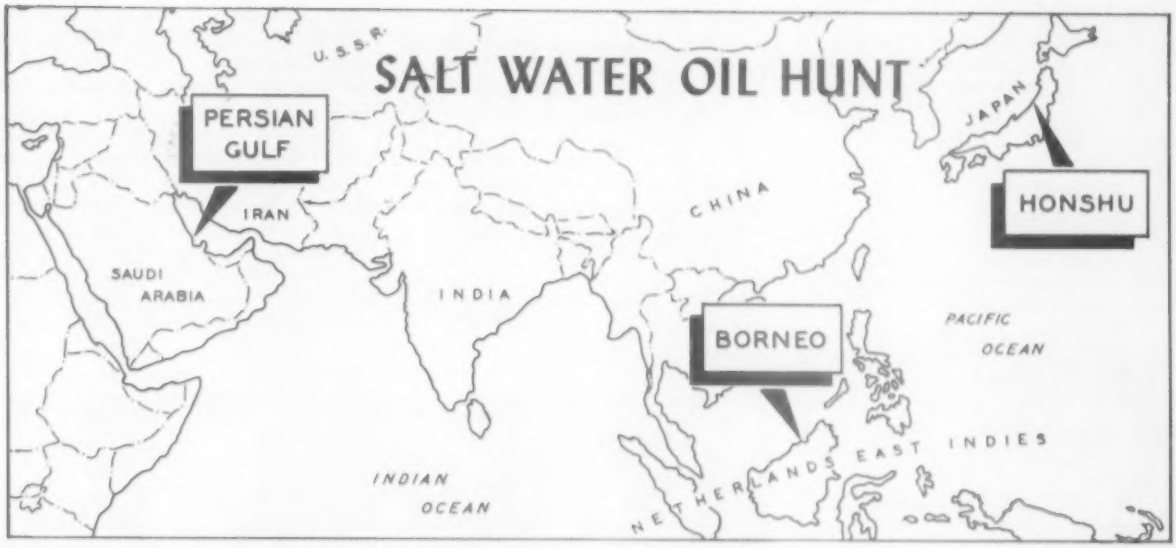
Safaniya, just off the coast of Saudi Arabia near the Neutral Zone border, will be on full production within a year. The field has over 70,000 proved productive acres and 17 wells, 15 of them in the Gulf. All the wells are shut in awaiting completion of the 140-mile 22-in. pipeline to Ras Tanura.

The Safaniya production was discovered in 1951 by Aramco. Since that time the company has carried on a steady drilling program in the gulf waters. The 5,600-ft. Safaniya field wells have all been drilled from a single marine drilling barge, the "Queen Mary," which is 174 ft. long and 70 ft. wide with only a 12-ft. draft. The barge is firmly anchored to permanent platforms sunk into the Persian Gulf bed until a well is completed. Then tugs tow it to a new location for another well.

Persian Gulf popular . . . The Persian Gulf also has proved attractive to several other oil searchers.

Matbakh 1, the first offshore wildcat drilled by Shell Oil Qatar, Ltd., 5 miles off the east coast of the Qatar Peninsula and about 35 miles north of Doha, was abandoned last year at 6,700 ft.

Since that time the marine drilling platform used by the Shell company



has been towed to Idd el Shargi, about 50 miles east of Doha, for a second test in 50 ft. of water. The 1,900-ton, self-contained platform being used for the operation is designed for drilling a 12,000-ft. hole.

Shell obtained its concession 4 years ago after Superior Oil Co. relinquished its offshore concession holdings. The first Shell well was spudded after more than 18 months of seismic work.

In the waters off Abu Dhabi and Dubai on the Trucial Coast of the Arabian Peninsula, a two-company operation has begun a shallow core-hole drilling program in an area about 50 miles from shore. This new study of the Persian Gulf seabed is expected to supplement seismic work already done by Abu Dhabi Marine Areas, Ltd. The company is jointly owned by British Petroleum Co., Ltd., and Cie. Francaise des Petroles.

The seismic work was carried out from a converted landing craft. A 1,200-ton cargo vessel fitted out to drill the core holes is now being used in the work. The 12,000-sq. mile offshore concession was acquired by the two companies when it was relinquished by Superior Oil. B.P. owns two-thirds of the concession and C.F.P. has the other one-third interest.

British Borneo . . . The two Royal Dutch-Shell companies operating in British Borneo have been edging seaward for several years and both are now engaged in a major program of offshore drilling activities.

There are six marine drilling platforms either in operation or under construction off the coast of the British colony *(The Oil and Gas Journal, April 14, page 118)*. Four are comparatively close inshore just off the state of Brunei. A deep-sea platform is now being constructed at Ampa Patches, 25 miles off Brunei in the South China Sea. A similar platform is being built at a location called Siwa, 8 miles off the coast of northern Sarawak.

Another 60 wells in British Malayan Petroleum Co., Ltd.'s, prolific Seria field are deviated under the South China Sea floor from beach locations or from short boardwalks built from the shore.

British Borneo's two fields now produce 115,600 bbl. daily and B.M.P. and its sister company, Sarawak Oilfields, Ltd., are looking to sea to increase the output. Seria field, all but drilled up on land, furnishes 114,100 bbl. daily of the colony's total production and Miri field in Sarawak accounted for 1,500 bbl. daily.

At Seria B.M.P. has the following:

. . . Platform A is about a mile offshore and is connected to the beach with an aerial ropeway capable of carrying 5-ton loads. Four wells have been completed from this platform at depths ranging from 6,000 to 7,500 ft. Two of them produce about 560 bbl. daily each. The other two are shut down for repairs.

. . . Platform B is also about a mile from shore. Two wells have been completed from this platform and two more are planned, but there is no production pending the completion of the drilling.

. . . Platform C is about a mile offshore and 2 miles from "B." One well recently was completed from this unit at about 8,000 ft. and three more are planned.

. . . Platform E is the most recently constructed. It is only 1,000 ft. from the beach and connected to land by a Bailey bridge. The first of four wells to be drilled from this location was spudded early this month.

. . . Ampa Patches is a series of coral reefs which rise to within 30 ft. of the surface of the South China Sea 25 miles offshore from Tutong, Brunei, 30 mile up the coast from Seria field. The miniature submarine mountain range of coral is regarded by B.M.P.'s geologists as a promising drilling site.

The company is now building a permanent-type drilling platform here. It will actually consist of two platforms. One will contain the drilling rig and all necessary equipment and a second less elaborate platform is for living accommodations for crews.

. . . Siwa, 8 miles off Sarawak and about 18 miles from the declining Miri field, appears on no charts. It got is name from the Sungei Siwa, a small jungle river that empties into the South China Sea opposite the drilling site where Sarawak Oilfields is erecting its offshore platform. The platform is identical to the one at Ampa Patches, but it will be drilling in about 75 ft. of water.

Trinidad . . . With the depletion allowance they long have sought, the three operating companies with interests in Trinidad Northern Areas, Ltd., are expected to step up future drilling operations off the British Caribbean colony.

The depletion allowance — restricted to marine drilling operations—is not as liberal as that in the United States. But it will probably spur more effort in the expensive field of drilling over water.

T.N.A. recently announced plans for two more wells from its platform in the Gulf of Paria, 6 miles off Cedros Point at the southwest corner of Trinidad. The first well drilled from the platform, Soldado 1, was completed as a producer last year. It has been de-

scribed as a "Trinidad-type well" and as a "moderate producer" by the interested companies, but reports indicate it is making about 160 bbl. daily.

In addition to the platform drilling, T.N.A. drilled six directional wells from the shore near Point Fontin and now has seven of these wells producing. T.N.A. is owned jointly by British Petroleum Co., Ltd., Trinidad Oil Co., Ltd., and Shell Trinidad, Ltd. The Shell company is carrying out the marine operations.

Japan . . . Teikoku Oil Co., in which the Japanese Government has an interest, is leading efforts to boost Japan's meager domestic oil production by moving out to sea with a drilling program.

Teikoku Oil is now building a drilling platform for use in the Japanese Sea off the northwest corner of the principal Japanese island of Honshu.

The first well is planned for a location only about 700 ft. off the coast of Akita prefecture near the fields of In-nai and Matsugasaki. Plans for marine drilling were made after geological surveys revealed promising structures. The first well to test the area was deviated 5,000 ft. from the shore at Koyagawa. It was completed in March.

The newly organized Oil Resources Development Co., a semigovernmental subsidiary of Teikoku Oil, is directing the new exploration program.

Marine seismic operations . . . Seismic and underwater geological work in areas where drilling has not actually started are almost too numerous to mention.

In addition to the seismic work being carried out on the Persian Gulf, companies active in the Caribbean have undertaken preliminary surveys in several areas.

A sizable portion of the Cuban acreage which Cuban Stanolind Oil Co., Tulsa, has obtained in Cuba is offshore. Aero Service Corp., Philadelphia, recently completed a combination aerial photo-magnetometer survey of more than 12,000 sq. miles of ocean area off Cuba for the Stanolind company *(The Oil and Gas Journal, April 9, page 85).*

Subsidiaries of Standard Oil Co. of California and Gulf Oil Corp. are carrying on a joint marine seismic survey of a 1,700-sq. mile area in the Bahamas about 200 miles southwest of Nassau. Both companies have concessions in the Bahamas region.

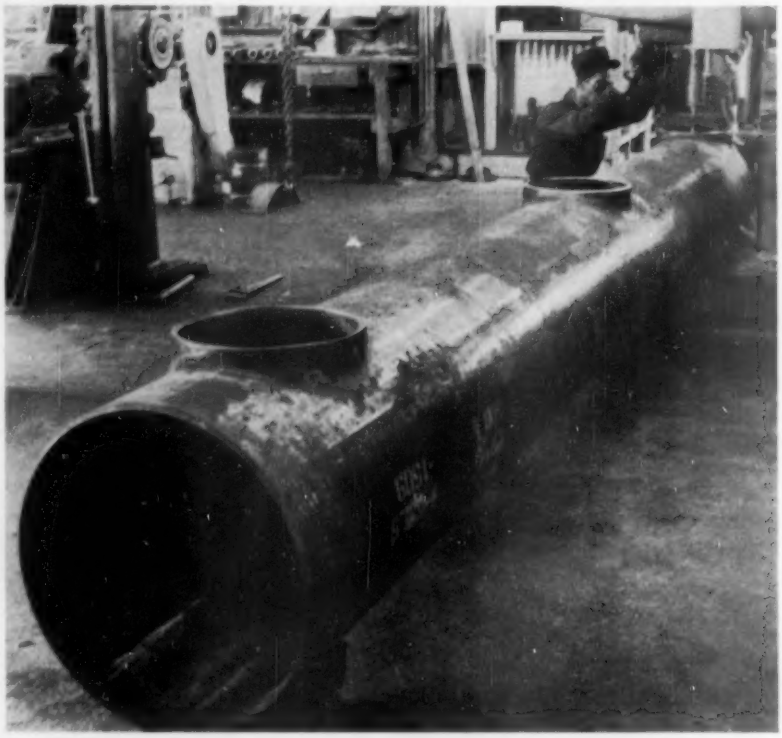
A number of companies have done over water seismic work off the eastern coast of Venezuela.

Almost half the area of the world's most recent exploration concession lies offshore. Pakistan Shell Oil Co., Ltd., has made no disclosure of its plans for the area, but the company only last week received a 10,000-sq. mile concession in East Pakistan, most of which lies in the Bay of Bengal.

The newly organized company is owned 75 per cent by Royal Dutch-Shell and 25 per cent by Pakistan capital *(The Oil and Gas Journal, June 18, page 150).*

Behind the Iron Curtain . . . While very little is known of a detailed nature about the marine operations of the Russians, there is every indication they are stepping farther and farther out into the Caspian Sea in the Old Baku region.

Some estimates of the proved offshore reserves in the Caspian are as high as 200 million barrels. It is known that the Russians have carried on an intensive over-water drilling program in the sea since shortly after the end of World War II. Some of these Caspian wells have been credited with production as high as 1,700 bbl. daily.



Cold Extrusion Latest Oil Shop Tool

THE cold extrusion of steel—a process with spectacular success in the ordnance and automotive industries—has come to the oil industry.

A new process for cold extruding nozzle outlets in piping and vessels for refineries and other petroleum processing plants has been developed by Fluor Products Co. at its Paola, Kans., plant. Simplified design and reduced welding are among the benefits claimed.

Fluor uses mechanical pressures of 100,000 to 400,000 psi. in forcing the unheated steel to flow around the contours of a die. Metal formerly in the pipe or vessel wall forms the wall of the nozzle. The resulting extrusions have high strength and highly uniform wall thicknesses.

Fluor engineers took their cue from results in ordnance and auto use of the process to develop new machinery and die lubrication techniques so the process could be applied to piping and vessel components. Steel up to 1½-in. wall thickness thus can be handled.

In the photograph above, is a 20-in. header of ½-in. wall thickness in which three 12-in. nozzles have been extruded. As an example of flexibility of design possible, headers with openings at 90° of each other and with nozzle sizes ranging from 3 to 12¾ in. have been produced.

If properties of a hot-forged fitting are desired, they are provided by annealing the cold extrusion. (A detailed feature article of the new process will appear in the July 16 issue of The Oil and Gas Journal.)

Pipeline Contracts Let

Four of seven Trans-Canada spreads contracted; right-of-way work started, western leg to be completed this year

TORONTO.—Trans-Canada Pipe Lines Ltd. has awarded contracts for four of the seven spreads on the 574-mile western leg of the line which will bring Alberta gas to Winnipeg this winter.

Single spreads were contracted to Majestic Contractors Ltd., Edmonton; Canadian Bechtel Ltd., Toronto; Mannix Ltd., Calgary; and Dutton-Williams Bros. Ltd., Calgary. The other three are to be announced later.

Majestic and Canadian Bechtel, awarded the first two sections, started moving in men and equipment immediately. Grading was started last week at the Burstall, Sask., terminus near the Alberta-Saskatchewan border.

Mannix and Dutton-Williams Bros. are organizing crews and will move in equipment soon.

Dutton-Williams Bros. plans to start right-of-way operations July 15, a month before pipe delivery is due for the spread.

A hundred miles of the 34-in. pipe has been stockpiled. Deliveries started 2 weeks ago at the western end. Three U. S. mills are supplying the big-inch pipe and no delay is foreseen, barring a labor tieup. Each spread should be able to lay pipe at the rate of a mile a day. The region is marked by numerous water holes but otherwise offers no terrain problems.

The prairie section of the 2,250-mile, $378-million line, which eventually will be carried to Montreal, is to be completed by December 31. But Trans-Canada hopes to beat that deadline by a full month. The company plans to start delivering 21,000,000 cu. ft. of gas daily to Winnipeg before the year is out. Other customers will probably be signed up in the meantime.

Field organization . . . Construction will be directed from the Regina division office which Trans-Canada set up last week.

K. E. Britain is division project engineer in charge of the office. D. C. Calder is right-of-way supervisor.

District offices are being set up at Brandon, Man., and Swift Current, Sask.

Both American and Canadian personnel will be used on the pipeline. Trans-Canada announeed a policy of using local Canadians wherever possible, but noted a manpower shortage existed in the Regina district. Canadians will be trained for jobs which require experienced personnel.

Next step . . . The Canadian government finally got the project off the ground, after 5 years of planning, by approving a loan for $72 to $80 million to provide 90 per cent of the cost of the western section *(The Oil and Gas Journal, June 11, page 82)*.

But the timetable beyond Winnipeg depends on the Federal Power Commission.

FPC approval for an affiliate of Tennessee Gas Transmission Co. to import gas from Trans-Canada at Emerson, Man., for sale through the U. S. Midwest would firm up private financing for the line. The application is still being debated.

The U. S. market could put Trans-Canada on a profitable basis. With a crown company building the uneconomic northern Ontario section, Trans-Canada could extend the line to the big markets in eastern Canada. Ultimate capacity would be 650,000,000 cu. ft. daily, providing an outlet for one-fourth of Alberta's entire gas reserves.

Capital delivered . . . Trans-Canada received the first installment on the government loan—$6,774,000—last week.

The loan is being made through the Northern Ontario Pipe Line Crown Corp. The crown corporation received a 5 per cent mortgage bond from Trans-Canada.

With construction started, Bailey Selburn Oil & Gas, Ltd., of Calgary announced it will drill five development wells in Bindloss-Atlee field which will supply the pipeline's first-year requirements.

Baysel is completing negotiations to supply 7,000,000 cu. ft. daily from the field in which it holds 56.5 per cent interests.

Trans-Canada Markets Growing

CALGARY.—Trans-Canada Pipe Lines, Ltd., has signed its second big sales contract for deliveries which will build to more than 100,000,000 cu. ft. daily.

N. E. Tanner, president of Trans-Canada, said the deal increases the possibility that Trans-Canada will be able in the near future to finance the Alberta-Montreal line on the basis of Canadian sales alone without exporting to the U. S. (see story this page).

The new agreement is with Northern Ontario Natural Gas Co., Ltd., which serves 25 municipal districts and numerous industries between Canora and North Bay. Deliveries the first year will be 57,000,000 cu. ft. daily and will increase to 100,000,000 cu. ft. in the fifth year.

Tanner estimated that, even without expected increases over the 20-year life of the contract, it would produce revenue of $225 million.

Trans-Canada last month signed a $300 million contract with Union Gas Co., Chatham, Ont. *(The Oil and Gas Journal, July 25, page 71)*. Deliveries to Union would reach 175,300,000 cu. ft. daily after 13 years and level off at that figure.

Ontario market growing . . . The encouraging aspect of the new contract is that the gas purchased will serve the sparsely populated area of northern Ontario to be spanned by the "uneconomic" section of Trans-Canada.

This section of the 2,250-mile line is to be built by a crown company with federal and provincial funds and leased to Trans-Canada.

R. K. Farris, president of Northern Ontario Natural, said his company will serve a large industrial market, including smelting and refining industries and pulp mills.

Some industrial customers will purchase substantial amounts of gas on an off-peak seasonal basis when the normal heating load is small.

Northern Ontario Natural plans a $32-million distribution system to serve its market with Trans-Canada gas.

Alberta Gas Firm Gets Loan

EDMONTON, Alta. — The Alberta Gas Trunk Line Co. will receive a $3,690,000 loan from the Alberta government to finance a field gathering system. The firm will supply natural gas at the Saskatchewan border to Trans-Canada Pipe Lines, Ltd.

The funds will be lent in three separate amounts. Alberta Premier Manning said this plan was followed because only a small part of the natural-gas gathering system will be needed this year to meet Trans-Canada demands.

The first loan of $2½ million will be made July 1. Others will come in August and September. Interest will be 4½ per cent for 2 years.

Middle East Cut Asked

Flemming calls on importers to East and Gulf coasts to slash schedules for third quarter by 97,000 bbl. daily

WASHINGTON.—Importers of Middle East oil on the East and Gulf coasts were urged last week to keep their third-quarter imports of crude 4 per cent below the daily average of actual imports through the first half of the year.

The cutback was called for by Mobilization Director Arthur S. Flemming. Reduction is necessary if "substantial conformity" with the cabinet committee's February 1955 formula is to be attained, he said.

Flemming disclosed that the cabinet committee has just made a study of importers' third-quarter programs. It found that if those programs are carried out imports will be "considerably in excess of the formula," he said.

In a letter to importers, Flemming stressed that the cut is to be made voluntarily. And, he added:

"It is our hope that the reports which will be submitted early in July will make it possible to find that voluntary action has been taken by each importing company in connection with its planned imports for the third quarter of such character as to constitute substantial conformity with the advisory committee's conclusion."

Public hearing threatened . . . If the importers get their entries into line with the formula, it will not be necessary to hold a public hearing next September, Flemming indicated. He threatened the hearing if a new task force study now being made shows the voluntary program isn't working.

The task force has already held its first meeting and is now making its study. It is to report to the cabinet committee by September 1.

The new call for an import cut applies only to importers east of the Rocky Mountains and does not apply to Canadian or Venezuelan crude.

Venezuela, Canada watched . . . The committee, however, is continuing a close watch on all imports into District 5 and imports into the other districts from Canada and Venezuela, Flemming said.

If any of these imports at any time threaten to impair our national security position, the committee will publicize its conclusions and will make appropriate recommendations, he added.

The cabinet committee's latest study showed that importers planned to bring in 385,000 bbl. daily of crude during the coming quarter. Imports during the first half of the year are figured at about 300,000 bbl. daily. To get third-quarter receipts 4 per cent under the first half would require a cut of 97,000 bbl. from planned imports, to 288,000 bbl. daily, it was indicated.

Gulf makes cut . . . Gulf Oil Corp. announced immediately it will reduce its daily average planned imports for the third quarter by 8,400 bbl. This will be 2,426 bbl. daily below the daily average of actual imports for the first 6 months.

Gulf officials said the reduction would comply with Flemming's request for a 4 per cent cut in the daily level of imports.

Gulf also stated it cut back 7 per cent of its Middle East imports in the first quarter in compliance with earlier recommendations by Flemming and was disappointed that the industry as a whole did not comply more generally.

But Gulf restated its position that by imposing the whole reduction in imports on Middle East crude Flemming was discriminating between sources of oil. This was termed a serious mistake in international relations which may harm the United States in all of the Middle East.

Trustee wants to spread risk so . . .

. . . A.C.S. May Sell U.O.P. Stock

NEW YORK.—A move is under way to sell all or part of the stock ownership in Universal Oil Products Co. held in trust for the American Chemical Society.

Guaranty Trust Co. has filed a petition with the New York Supreme Court asking authority to sell the securities. Guaranty Trust is trustee for the Petroleum Research Fund which holds the stock. All profits from the fund go to the society for petroleum-industry research.

Guaranty in its petition asked for the right to sell the stock at such time as it deems the sale would be in best interests of the trust. It explained the fund needed a more diversified portfolio of securities which over the years would provide a larger and more stable income. U.O.P. stock now provides principal assets of the fund.

The American Chemical Society, which administers the research program financed by the fund, also informed the court through resolutions of its board of directors that it concurs in the application of the trustee.

All officials concerned in the action declined to elaborate on their future plans or to identify any possible buyer of the stock.

U.O.P. is one of the oil and petrochemical industry's major research and development organizations. It was turned over intact to the chemical society by its original oil-company owners in 1944. A stipulation of the gift was that U.O.P.'s profits would be used by the society to further scientific research in the petroleum industry *(The Oil and Gas Journal, September 23, 1944, page 142).*

Subsequently a trust—the Petroleum Research Fund—was set up to administer the gift. Guaranty Trust was named trustee of the U.O.P. securities for benefit of the A.C.S. Management and operation of U.O.P. was placed under direction of a board to be appointed by Guaranty Trust.

Presentation of the gift was made to the society at its 108th annual meeting in 1944 in New York. At that time Dr. Thomas Midgley, Jr., society president, announced to A.C.S. delegates:

"The net profit from the Universal Oil Products Co. will flow to the American Chemical Society to be used for research in the petroleum and natural-gas field.

"The society will have no obligation insofar as the management of U.O.P. is concerned. The society, on the other hand, will have absolute discretion in the matter of selecting the research projects. The society can withdraw at any time it feels that it should not act further and it can then disclaim any interest in the trust."

Gasoline Plant on Stream

PEETZ, Colo.—A nearly automatic natural gasoline plant has gone into operation at Lewis Creek, 6 miles west of here. It was installed for Ginther, Warren & Ginther by Russell Engineering of Houston.

The plant, with daily capacity of 5,000,000 cu. ft., is the firm's third in northeastern Colorado's Logan County. It will process natural gas from Lewis Creek and West Peetz fields, returning residual gas outflow to lines of Kansas-Nebraska Natural Gas Co. A single operator will run the plant.

SURFACE SINKING caused by oil production from Wilmington field keeps Long Beach busy holding harbor above sea level. Workmen are building more levees like one in background to keep port area from being flooded at high tide. Buildings and pumping units in foreground, where subsidence exceeds 20 ft., will be raised by earth fill to level of levee in background.

OFFICES of Long Beach Harbor Department (left) and Long Beach Oil Development Co. (right) will be raised to level of surrounding dikes. So will pumping units. Part of the area pictured is 20 ft. below sea level, and subsidence will force Long Beach to continue its . . .

Struggle to Keep Out the Sea

LONG BEACH, Calif.—Subsidence threatens to turn the harbor area here into a Netherlands-like maze of dikes and levees.

The fight to keep the ocean in its proper place is a continuing one as engineers and heavy equipment rush to build additional protective structures.

Current projects include construction of 20-ft. steel-and-concrete reinforced bulkheads along the site of the old Navy pier at the foot of Pico Street. Earth is then piled behind the bulkheads to keep the threatening harbor waters from flooding the port area during high tide. Similar work is under way on nearly a mile of piers along the Embarcadero.

The Long Beach Harbor department has already spent $26,000,000 in fighting and repairing subsidence damage and estimates that by 1970, when subsidence is expected to stop, they'll have spent more than $88,000,000 on this work.

Another project which has been under way for some months has been to raise the ground level all along the waterfront by 20 ft. Trucks have hauled in and dumped more than 16,000,000 cu. yd. of dirt behind bulkheads and another 14,000,000 cu. yd. are needed to finish the job.

In addition to raising the ground level back to approximately where it was before subsidence began, the work of raising oil producing facilities has continued. So far 125 wells have been raised to the top of earth fills. Fifty are still to be raised.

The cause . . . Subsidence in the Long Beach Harbor area is related to production of oil from the Wilmington field. This is the largest oil field in California. Current production exceeds 100,000 bbl. daily.

Specifically, engineers state production from three zones, Tar, Ranger and Terminal, has resulted in the 22 sq. mile subsidence area which is 22 ft. deep at the center. These three zones have produced more than a billion barrels. Continued production at present rates will result in an additional drop of 13 ft., engineers state.

What's ahead . . . The growing threat of subsidence in the downtown business area of Long Beach is also causing alarm among the city fathers.

Originally, a subsidence of 4 ft. in the downtown region was predicted. Now, however, if the undeveloped southeastern part of the Wilmington field is drilled and produced, a drop of 8 to 10 ft. is forecast. Subsidence of that size would be disastrous in the highly developed parts of the city, engineers point out.

Up to this time, the battle against subsidence has taken the form of remedial work on damage already done. Several projects, such as gas or water injection programs, have been studied with a view to actually halting subsidence.

Dr. Frank G. Miller of Stanford University reported last year that a 1,000,000 bbl. per day salt-water injection program would eventually halt subsidence and restore reservoir pressures in the field. But, if such a water injection program were to be started immediately, it would take 3 years just to fill the voids already created by production from the three zones involved, Miller warned *(The Oil and Gas Journal, November 28, 1955, page 48).* In the meantime, an additional 3 to 4 ft. of subsidence would take place.

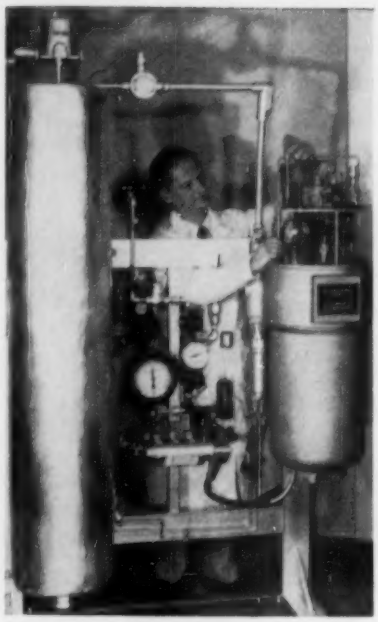
Lab device gets refinery job . . .

Analyzing Gases Automatically

LINDEN, N. J. — Chromatography, a 50-year old laboratory technique, is now being applied to everyday refining operations.

One of these chromatographs (photo) is now in trial operation on a polymerization unit at Esso Standard Oil Co.'s Bayway refinery here. A second is to be installed shortly in the refinery's gas-absorption plant.

The Esso units were designed and built by Charles W. Skarstrom. They are the first tailor-made chromatographs to be used in automatic analysis of refinery gases, Esso says. Skarstrom has improved on the 1906 invention of Michael Tswett by combining the basic technique with one of his own which was devised to measure traces of water in hydrocarbon streams in refining units.



How it works . . . Here's how Skarstrom's unit works.

Samples of gas are propelled by a steady flow of dry air through 20-foot columns packed with activated alumina. In passing through these columns, the components in the gas mixture separate from one another because they travel at different speeds. They emerge from the column one after another and are moved directly to a special detector.

This second device consists of a small bed of activated carbon which heats up when the sample components flow through it. Different components give up different amounts of heat. The bed heats up for only 5 seconds and then is cooled for a period of five seconds as fresh air flushes out the various consecutive components.

The amount of heat given up by each component is measured by thermocouples and recorded in the unit control house. The continuous record gives a direct reading on the type of components in the sampled stream.

The device makes an automatic analysis of the propane-propylene feed stream to the polymerization unit every half hour. This has afforded unit operators a frequent accurate analysis of poly feed stock, and variations in feed components can be detected quickly. The advantage over the once-daily laboratory analyses is expected to save the company many times the instrument's $12,000 cost.

Application spreading . . . Chromatographs are gaining in laboratory use throughout the industry, and Esso's application to continuous stream analysis in the refinery indicates that the instruments should find even wider use in process evaluation and control. The instruments can be purchased from manufacturers, or they can be revised from standard devices on the market. In Esso's case they were designed and built under the affiliated Esso Research & Engineering Co.'s "control of processes" project. This unique program matches invention to need in meeting the varied needs for automatic gas analysis by manufacturing members of the Standard of New Jersey family.

From 1949 through 1953 a total of 28 special plant instruments has been supplied by Esso Research to various Esso refineries at an outlay of $300,000. Esso estimates that these instruments have saved $5 million in operating costs.

As the picture indicates, the chromatograph in use at Bayway refinery is surprisingly large. There are two reasons for its size. It is assembled from standard parts which can be readily replaced, and it was made explosionproof and weatherproof since it is located on a process unit.

Louisiana, U. S. to Seek Offshore Pact

BATON ROUGE.—Future of drilling operations in the twilight zone of Louisiana's offshore oil fields is now hinging on compromise talks here and in Washington.

Louisiana and federal officials hope to confer in Washington early this week on a plan to prevent a shutdown. But state leaders first must reach an agreement with oil operators over an escrow plan.

Stumbling block in any agreement between the state and oil companies has been the state demand that the companies which already have paid the federal Government for leases also place the same amount in escrow with the state. If this is resolved, Louisiana officials then can work on the state-federal agreement.

Deputy U. S. Atty. Gen. Warren Olney advised state officials and the Louisiana congressional delegation last week that the Justice Department is willing to enter into an escrow agreement.

Atty. Gen. Jack Gremillion and State Minerals Board Chairman William G. Helis, Jr., have arranged appointments with Wesley D'Ewart, of the Interior Department. A tentative conference has been set up for today to discuss the issue.

The action came quickly after Gov. Earl K. Long signed into law the "escrow bill." It permits Louisiana officials to negotiate with the federal Government on an agreement to permit drilling until the U. S. Spreme Court can determine Louisiana's offshore boundary *(The Oil and Gas Journal, June 25, page 79)*. All lease and royalty money from the disputed areas would be deposited in escrow.

The Supreme Court in a decision last month banned new leasing or drilling in the twilight zone claimed by both the state and Government while it was deliberating the issue. Then it took off on a 3½-month recess. The court left the door open to continuing offshore activity by mutual consent of the disputing parties.

Louisiana claims title out to 3 leagues from a theoretical "coastline" which in some cases would put its boundary 30 miles out to sea. The U. S. holds that the state's territory does not go beyond 3 miles from shore.

Louisiana sues Humble . . . The battle over the federal-state boundary entered a new phase last week. Louisiana sued Humble Oil & Refining Co. for an accounting of production from disputed offshore lands claimed by the state and the U. S. as well.

The leases in question fall within the area 3 leagues seaward from the coastline.

FPC Sets Hearings

Bitter struggle ahead for Texas-Florida gas project

WASHINGTON.—Hearings start before the Federal Power Commission next week on projects to carry Texas gas to Florida. And indications point to a bitter contest.

The $174,000,000 joint project of Coastal Transmission Corp. and Houston Texas Gas & Oil Corp. would give a number of Florida cities an initial natural gas supply of 370,000,000 cu. ft. daily and eventually as much as 520,000,000 cu. ft.

Coastal Transmission plans a $68,-251,000 pipeline from Hidalgo County, Texas, to a point near Baton Rouge, La. Houston would pick the gas up there for a $105,836,000 line covering a wide area of Florida.

The project is meeting opposition from as far away as New York. More than 80 petitions to intervene have been granted by the FPC.

Opposing interests include utility companies, cities, manufacturing concerns, gas districts and other groups. Some are as remotely located as the New York Public Service Commission.

Eight petitions were turned down by the FPC. Three of these were by companies planning similar projects. The commission said these companies—Colonial Natural Gas Corp., Trans-Gulf Transmission Corp. and Georgia Coastal Natural Gas Corp.—will have an opportunity to file new petitions if and when competing applications are filed by them.

The other rejected petitions were by utility companies. They claimed the pricing provisions in the Coastal and Houston contracts with producers may adversely affect the price their own suppliers may have to pay for gas.

The FPC rebuked the petitioners for assuming "complete abnegation by us of our duties to regulate rates at which independent producers sell natural gas to transmission companies and failure by us to be alive to the protection of the public interest."

Construction Strike Ends

BEAUMONT, Tex.—The signing of 2-year work contracts has ended a strike which had paralyzed construction projects at numerous refining and petrochemical plants since April 2.

More than 1,000 workers have returned to the job since striking unions reached agreement with the Sabine Area Construction Committee and the Gulf Coast Piping Contractors Association, and the number is expected to increase tenfold as activity returns to normal.

Areas where work has been resumed include: E. I. du Pont de Nemours & Co., Inc., and Magnolia Petroleum Co., Beaumont; Neches Butane Co. and Goodrich-Gulf Chemicals Co., Port Neches; The Texas Co. and Gulf Oil Corp., Port Arthur; Pure Oil Co., Nederland; and Firestone Rubber Co., Spencer Chemical Co., and Du Pont Co., Orange.

New Engine Tested

Texaco expert sees wide use for free-piston type

NEW YORK.—Interest is growing in the free-piston engine.

The Texas Co. has what it believes is the first engine of this type to be installed in a petroleum laboratory in the United States. Its researchers are conducting tests to determine the engine's fuel and lubricant requirements.

This power source is going to have greater use in this country, said Dr. Wayne E. Kuhn, general manager of Texaco's research and technical department. Interest ranges from use in powering the family car to moving a liberty ship.

Texaco is starting with a single cylinder, 60-hp. SIGMA free-piston unit imported from France and recently installed at Beacon laboratories. It is now being operated as an air compressor.

Possible combination of the free-piston engine with the gas turbine holds high interest. Free-piston combustion gases are much cooler than turbine-engine gases. This would permit cheaper, less critical materials in the turbine blades. The efficiency of the free-piston engine is higher than present piston engines, coming close to that of the diesel engine, Dr. Kuhn said.

Oil Men Gird For Vote Fight

LOS ANGELES.—W. H. Geis, consulting geologist, petroleum engineer, and independent oil operator of Los Angeles, will serve as chairman of the committee organized to lead a fight against California's proposed conservation law.

Formation of the committee assures organized opposition to the bill. The issue will be on the November general election ballot as an initiative referendum.

Other officers of the "California Committee Opposed to Oil Monopoly" are L. R. Seaman, Bakersfield, president of Intex Oil Co., vice chairman; Alphonzo E. Bell, Jr., Los Angeles, president of Bell Petroleum Co., secretary; and E. G. Starr, Los Angeles, president of Universal Consolidated Oil Co., treasurer.

Broker Sues Majors

He says firms frustrated $109 million Iranian deal

NEW YORK.—A Denver oil broker is suing seven major oil companies in federal court here for $109,260,000 damages.

Gerald B. Waldron, president-owner of Consolidated Brokerage Co., Denver., contends the seven firms "completely and utterly frustrated" his efforts to sell 15,000,000 metric tons of Iranian oil.

Defendants in the action are British Petroleum Co., Gulf Oil Corp., Cities Service Co., Socony Mobil Oil Co., Standard Oil Co. (N.J.), The Texas Co., and Standard Oil Co. of California.

Waldron claimed he obtained an exclusive 5-year contract for Iranian oil after that country nationalized certain of its oil resources May 1, 1951. His suit alleged that illegal conspiracy by the defendant companies prevented him from selling the oil "substantially" below prices posted by defendants.

The suit charged further that the companies warned tanker operators that any participating in delivery of the Iranian oil "would be forever blacklisted."

Waldron alleged that this constituted a conspiracy designed to increase domestic prices of petroleum and monopolize trade and commerce in petroleum products between the United States and foreign nations.

New York to Retain Center

NEW YORK.—The Engineering Societies Center will remain in mid-town Manhattan if recommendations of a special task committee of 15 are followed.

The group recommended that present quarters be expanded to meet needs of the four societies making up the center. If this is not practical, they want a bigger site nearby.

Vote on the issue was unanimous, apparently scotching previous proposals of moving the center out of New York City.

The center is made up of American Society of Civil Engineers, American Institute of Mining, Metallurgical and Petroleum Engineers, American Society of Mechanical Engineers, and American Institute of Electrical Engineers.

A fifth organization, American Institute of Chemical Engineers, has been recommended for participation.

Lease Brings $4,250,000

Stanolind pays record price at Texas University auction for 3,840 acres in Pecos County; plans 16,000-ft. test

AUSTIN.—Stanolind Oil & Gas Co. broke all bidding records for University of Texas lease auctions last week. It bid $4,250,000 for a 3,840-acre drilling block in Pecos County, far West Texas.

The big bid, which figured to $1,154 an acre, was the highest for a single tract in the 37 auctions held during the past 20 years.

It boosted total receipts from the sale to $16,437,254 in bonuses for leases on 57,241 acres. This was an average bonus of $284.31 an acre.

The high-priced Stanolind lease block lies 12 miles northwest of Puckett field, the nearest production. Stanolind was pushed to the record bid in active competition for the tract with Phillips Petroleum Co.

Both companies bid heavily for Pecos County acreage. Stanolind was the high bidder on six tracts for a total of $4,915,000, Phillips on 15 tracts with bids totaling $1,533,000.

Deep wildcat . . . Stanolind's big block, Tract 116, requires the drilling of probably the deepest wildcat ever demanded of a bidder for a university lease. This is a test to 16,000 ft. or to the Ellenburger if that pay is found shallower than 16,000 ft. or to commercial production at a lesser depth.

Tract 122, in Pecos containing 3,680 acres and calling for a similar deep wildcat, went to Phillips for only $38,-000.

Second highest bid was Gulf Oil Corp.'s offer of $1,300,000 for 2,735 acres in Block 45, Crockett County. Nearest production is in Midway Lane pool, 5 miles to the southwest.

Despite Stanolind's big bid for the Pecos lease, it was not the highest per acre bid at the auction. This dubious honor went to American Trading & Production Corp., Midland, bidding $205,000 for a quarter section (160 acres) comprising Tract 14 in Block 4, Andrews County. The bid figures out to roughly $1,281 an acre.

Other bidders . . . The University of Texas offered six drilling blocks other than the two taken by Stanolind and Phillips in Pecos County and the one by Gulf in Crockett County.

High bids on these were:

Gulf, $100,000 on 1,279 acres in Reagan County; Forest Oil Corp., $300,000 on 2,565 acres in Crockett County, Gulf, $300,000 on 1,312 acres in Crockett; W. A. Moncrief, $10,000 on 1,352 acres in Crockett; Ohio Oil Co. $85,000 on 2,562 acres in Ward County, and W. G. Ross, $130,000 on 2,562 acres in Winkler County.

The $16,437,254 from last week's auction hiked the reserved permanent university fund to $259,872,602.

Special Crudes Hiked

Humble posts 10-15-cent increase on three grades

HOUSTON.—Humble Oil & Refining Co. has posted price increases of 10 and 15 cents per barrel for three types of specialty crudes produced on the Gulf Coast and Southwest Texas. The change became effective June 28.

All the crudes are of medium gravity and the supply is limited. But they are in good demand because of special properties for making lubricating-oil stock and because they have a good yield of high-octane gasoline.

In announcing the new postings, Humble said that a general crude-price increase is not warranted at this time but that increases are in order for these special types because of their refining qualities and the high cost of production.

A 10-cent increase was posted for "Webster type" low-cold-test crude. The new scale ranges from $2.99 for below 24° to $3.13 for 30° and above.

A new grade called Refugio heavy was posted for three fields: Bonnie View, Greta, and Taft. This crude was raised by 15 cents, and the new postings range from $2.93 for below 20° to $3.07 for 26° and above. The price of all other Refugio-type crudes remains unchanged.

An increase of 15 cents was posted for Mirando crude. The new scale ranges from $3.01 for below 24° to $3.13 for 29° and above.

Navy Taking Shale Plant

WASHINGTON.—The Navy is taking over Interior Department's oil-shale plant at Rifle, Colo. But whether the research installation will be reopened or held in standby until next year hinges on the question of funds.

The answer lies in whether Congress makes available $500,000 put into the defense appropriation bill by the Senate.

Interior Department abandoned the project at the end of June when its operating funds ran out and it couldn't get new appropriations.

Navy wants to continue the shale research because material used comes from a Naval shale reserve.

New Plant Planned

Quick tax writeoff given for Washington project

WASHINGTON. — Another refinery in the Pacific Northwest was given the Government's blessing last week.

The Office of Defense Mobilization granted accelerated tax amortization on $14,300,000 of an $18,000,000 plant, largely for aviation gasoline, planned by New England Industries, Inc., for Bellingham, Wash.

The refinery, aiming at military contracts, would concentrate largely on alkylate. Plans call for a capacity of 1,500 bbl. per calendar day. It also would produce a substantial volume of butadiene, the disposition of which was not specified.

The ODM allowed quick writeoff of 100 per cent of the $9,900,000 cost of the alkylate unit and 40 per cent of $4,255,000 for refining equipment. No grant was made for the $3,-695,000 to be spent for butadiene facilities and land, since there is no federal expansion program for butadiene.

Plans and financing of the plant apparently were awaiting ODM action before being firmed up. The company's application indicated that building would not start before next January.

Yates-Sand Flood Planned

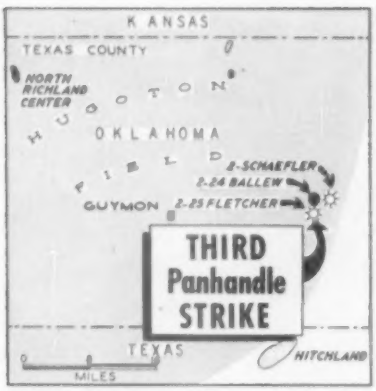
FORT WORTH. — Continental Oil Co. plans to water flood a 235-acre Yates-sand closure on its W. R. Settles "133" and "160" leases in Howard Glasscock field in West Texas.

The company expects to recover roughly 1,652,000 bbl. of secondary oil as compared with only 1,126,000 bbl. by primary methods.

The Yates under the Conoco leases in the Howard County portion of the field is one of a series of small Yates-sand closures scattered over the entire field. It has 19 producing wells, which averaged 166 bbl. daily in May. The pay is at 1,300 ft. and averages 15.5 ft. thick.

Conoco plans to start with seven injection wells, four of which will be drilled. Water will be gathered from other company leases and treated with hydrochloric acid prior to injection.

The Texas Railroad Commission is expected to approve the project within the next few days.



New Hugoton Strike

Big reserve indicated by 234,900-M.c.f. gas well

GUYMON, Okla. — Three Morrow producers in rapid succession give promise of a rich new oil and gas reserve in Texas County.

The latest of the three significant producers drilled by Panhandle Eastern Pipe Line Co. came in for an initial potential of 234,900,000 cu. ft. of gas per day. It is the 2-25 Fletcher, about 15 miles east of Guymon on the east side of the vast Hugoton gas field. Pay comes from perforations at 6,175-6,228 ft. in the Morrow-Pennsylvanian sand.

The third well, coming on the heels of two other strikes, indicates that the Morrow is an important new reservoir for this part of the field. Nearest similar production is to the southeast at the big Grand Valley-Camrick field in southeast Texas County.

The first important completion in the area was Panhandle's 2 Schaefler, with an initial potential of 7,012,000 cu. ft. daily. But this well was completely overshadowed by the 2-24 Ballew, which flowed 1,000 bbl. of oil daily plus 80,000,000 cu. ft. of gas. This discovery was considered the most significant inside Hugoton since North Richland Center field was opened several months ago on the west side of the shallow gas area. The big gasser just completed is located 1 mile south of the 2-24 Ballew.

The successes were scored early in Panhandle's 60-well drilling program recently announced for Hugoton *(The Oil and Gas Journal, May 14, page 224)*.

The main pay field in the old Hugoton gas field is the Permian Brown dolomite. In recent years, however, operators have been thinking in terms of deeper production from Pennsylvanian and even Mississippian pay zones. Producers like the Panhandle Eastern trio are ample testimony to the wisdom of this deeper drilling campaign.

Industry BRIEFS

BATON ROUGE.—The controversial 1½-cent increase in Louisiana's gas-gathering tax fell just short of passage. Voting was 65 for and 34 against. It needed a two-thirds majority. The bill was sponsored by Gov. Earl Long's administration.

SAN ANTONIO.—Slick Secondary Recovery Corp. has been organized here to engage in water flooding and other secondary-recovery operations.

Tom Slick, partner in Slick-Moorman Oil Co., and Slick-Urschel Oil Co., is chairman. Other officers are Robert V. West, Jr., formerly production superintendent of Slick-Moorman, president; Paul D. Torrey, Austin, consulting engineer, vice president; and Joe L. Stanton of San Antonio, vice chairman and treasurer.

BATON ROUGE.—Louisiana's daily oil allowable for July has been set at 738,805 bbl. This includes 15,000 bbl. of new production and is only 1,406 bbl. higher than the June allowable.

CORPUS CHRISTI. — South Texas Oil & Gas Co. has bought four gas wells in Singleton field of Bee County for $250,000. Seller was C. L. Pando Oil & Gas Co., Dallas. The wells are on a 2,600-acre lease about 15 miles west of Beeville. The gas is sold to Texas Eastern Transmission Corp.

AUSTIN.—Commissioners of Travis County, Texas, have called for bids July 23 on oil and gas leases on 19,000 acres of public school lands in Throckmorton County, North Texas.

MIDLAND, Tex. — Magnolia Pipe Line Co. last week estimated damages to its tank farm here exceeded $200,000. Lightning struck and ignited two 55,000-bbl. tanks June 22. The two tanks and about 35,000 bbl. of crude oil were burned.

TULSA.—Great Frontier Mining Co. has contracted to buy 1,280 acres of oil-producing properties in Osage County, Oklahoma, and is negotiating for more producing leases. Acreage already under contract produces about 250 bbl. daily.

HOUSTON. — Anderson Brothers Corp. has transferred its pipeline contracting assets to Paul E. McDaniel, Houston business man, in return for uranium interests.

Carl Anderson, president of the contracting firm, said his company's property and equipment in Texas, Minnesota, Wyoming, New Mexico, Montana and Louisiana were transferred to McDaniel. Anderson received uranium interests in New Mexico and substantial blocks of stock in several uranium corporations. Anderson recently sold its physical equipment in Venezuela, Colombia, and Canada to Williams Brothers Co., Tulsa pipeline contractors.

HELENA, Mont. — The Montana Land Board expects to receive a half million dollars in bonuses and rentals from leasing of 84,340 acres of state-owned land at an auction July 16. The 209 tracts to be offered will go at the regular 12½ per cent royalty rate.

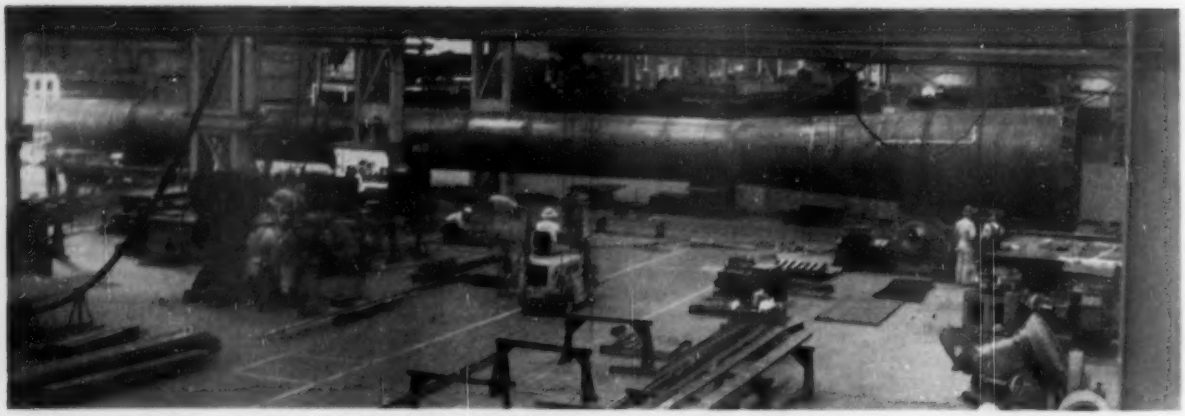
LOS ANGELES.—Union Oil Co. of California has been issued a building permit by the city for its $20 million office building in downtown Los Angeles. The project includes a 13-story office building flanked by three auxiliary buildings and a three-level underground garage for parking 1,500 cars.

NEW YORK. — Standard Oil Co. (N. J.) paid the equivalent of $5 million for Pate Oil Co., a deal which put Jersey into the Midwest market *(The Oil and Gas Journal, June 11, page 87)*. Jersey paid Pate 87,500 shares of its common stock, it was disclosed in the application filed with the New York Stock Exchange. Pate's net worth has been described at about $2½ million, covering 140 service stations and bulk stations in and around Milwaukee.

TULSA.—Crescent Corp. has contracted to purchase, subject to title examination, producing properties in Acadia Parish, Louisiana, from Elge Rasberry and associates for approximately $2 million. The properties consist of nearly 1,200 acres of leases on which there are nine producing wells.

CALGARY. — Basco Oil & Gas, Ltd., and its wholly owned subsidiary, Basco Petroleums, Ltd., have purchased all assets of Meador & Gray, Ltd., a geological consulting firm here. Lee Meador, a partner in the latter firm, has been appointed chief geologist and assistant manager of Basco.

ST. LOUIS.—Sohio Petroleum Co. has announced plans for a 37-mile, 8-in. products pipeline between Mogadore and Girard, Ohio. Completion is set for November 1. A 33-mile, 10-in. products line from Mogadore to Cleveland is now being completed for Inland Corp. by Sheehan Pipeline Construction Co.



HUMBLE OIL & REFINING CO. looks to its 3 acres of shops for much of its fabrication needs. A recent result: this big stack.

Humble Does King-Size Fabrication Job at Home

BAYTOWN, Tex.—Humble Oil & Refining Co. has come up with a king-size fabricating job in the mammoth central shops building at its refinery here.

The firm's boilermakers and welders completely assembled a 130-ft. furnace stack.

Almost as complicated as the fabrication itself was the job of moving the big stack a half mile through the maze of obstacles between the central shops and Pipe Still No. 1, the site where it was erected.

The moving job turned out to be a minor engineering feat, requiring a considerable amount of advance slide-rule calculations. Transportation of the stack was tricky. It took a big trailer and a lowboy to get the job done.

Riggers previously laid out a route to follow and carefully measured turns and corners to make sure the stack could make it. In some cases, the tortuous maneuvering was accomplished with only inches to spare.

The stack weighed 18 tons. Made of carbon steel, it was 6 ft. in diameter at the top and 10 ft. at the bottom.

Fabrication "at home" was made possible by the immensity of Humble Oil & Refining's central shops building. The huge structure stretches out over nearly 3 acres, is completely air-conditioned and fitted out with the latest machine tools and equipment.

AFTER A TRICKY journey, it goes up without a hitch. ⟶

Taxes Start Now—Roads Later

WASHINGTON.—The 3-cent gasoline tax is here, scheduled for a stay of at least 16 years.

The higher tax, effective as of July 1, will help to pay for a 41,000-mile superhighway system authorized last week by Congress. With other taxes on tires, trucks, etc., it will raise the Government's $25 billion share of the 32.9 billion project.

The increased taxes on motor fuel will not be across the board. Congress this year gave farmers an exemption from the tax. It is further limited in the road bill to motor fuel used only by registered motor vehicles.

There will be no great spurt in highway building immediately. The bill as finally passed by Congress provides for pay-as-you-go construction. That means spending each year shall not exceed estimated receipts in the highway trust fund.

Over the next 3 years the annual fund for road-building will be less than $900,000,000. It will be apportioned on the basis of the present formula while Congress makes a study of the actual costs estimated to complete the interstate system in each state. Thereafter funds would be split on that basis.

One provision of the act calls for competition in filling station service along the interstate roads. This is designed to bar monopolies, such as have been granted on some toll roads.

Pressure Program on Tap

CALGARY.—A gas-pressure maintenance system is planned for Duhamel D-3 pool of Central Alberta by Mobil Oil of Canada.

Mobil plans to inject gas from the Viking zone of Duhamel field into the gas cap of Duhamel D-3. Injection will be through Socony Duhamel 32-3 well. The company will present its proposal of the project to the Petroleum and Natural Gas Conservation Board July 4.

Octanes Rise Again

Motor-fuel quality hits record high mark in June

NEW YORK.—The weighted average of motor-fuel quality broke through to two new records in June.

Premium grade hit 97.0 research-octane number and regular grade rose to 90.0 RON. These new highs were both 0.3 octane number above the previous month's survey, according to Ethyl Corp. They represent gains of 1.4 RON for premium and 1.7 RON for regular over the weighted averages in June 1955.

Of the 53 marketing areas where 850 samples were tested, 35 showed gains over May in premium-grade quality, including 13 which jumped one-half octane number or more. Averages of eight cities were unchanged and 10 declined.

Premium ratings ranged from an average of 92.6 in Salt Lake City to 98.0 in Corpus Christi. These are averages of several samples in each city. Many individual brands across the country showed ratings in excess of 98 RON. The spread on premium gasoline:

PREMIUM

	June 1956	May 1956	June 1955
90-90.9	0	0	2
91-91.9	0	0	1
92-92.9	1	2	1
93-93.9	1	0	5
94-94.9	3	4	17
95-95.9	7	9	8
96-96.9	18	18	19
97-97.9	22	19	0
98-98.9	1	1	0
Total cities	53	53	53
Wtd. avg. RON	97.0	96.7	95.6
Wtd. avg. TEL, ml./gal.	2.58	2.56	2.58

On regular-grade gasoline, 38 cities reported increases in antiknock quality, 15 of them by one-half octane number or more. Twelve showed decreases and three cities remained unchanged. There was a marked increase in the higher averages; six cities ranking 92 RON or better as compared with three in May and none in April. Regular-grade averages ranged widely, from 82.0 in Salt Lake City to 92.6 in Pittsburgh. The breakdown by cities for regular grade:

REGULAR

	June 1956	May 1956	June 1955
81-81.9	0	1	1
82-82.9	1	0	0
83-83.9	0	0	3
84-84.9	0	1	2
85-85.9	2	2	9
86-86.9	6	11	10
87-87.9	7	7	3
88-88.9	10	3	8
89-89.9	9	13	9
90-90.9	3	1	8
91-91.9	9	11	0
92-92.9	6	3	0
Total cities	53	53	53
Wtd. avg. RON	90.0	89.7	88.3
Wtd. avg. TEL, ml./gal.	2.32	2.30	2.22

Processing BRIEFS

BAYTOWN, Tex.—Humble Oil & Refining Co. plans a third cat cracker at its 313,000-bbl. refinery here. The new 55,000-bbl. unit is scheduled for completion within 18 months and will balance refinery operations. Humble already has nearly 110,000 bbl. of catalytic capacity here.

CHICAGO.—Pure Oil Co. has awarded contract for a 12,000-bbl. catalytic reformer and 17,000-bbl. feed preparation unit at its Lemont, Ill., refinery to M. W. Kellogg Co. Completion is scheduled for next summer. Another catalytic reformer is under construction at Pure's Smiths Bluff, Tex., plant.

FERNDALE, Wash. — General Petroleum Corp. is planning a $6,500,000 expansion program at its 37,000-bbl. refinery here. Major addition will be another 9,000-bbl. Sovaformer, to be built by Betchel Corp.

Two other projects include a stove-oil treater and a jet-fuel treater. Construction is due to start soon. Completion of the entire program is set for September 1957.

WICHITA. — Derby Oil Co. will increase capacity of its 16,000-bbl. refinery here to 20,000 bbl. late this year and put two other new units on stream September 1. It's part of a $700,000 expansion program started last year.

Units scheduled for September completion are an Ultraformer and Hydrodesulfurization unit. Each will have a 2,500-bbl. initial capacity, expandable to 4,000 bbl. The Ultraformer will produce 100-octane gasolines without a TEL additive. It's licensed from Standard Oil Co. (Ind.).

TORONTO.—A second Platformer, to be integrated with a Udex extraction unit, will be built here at the 30,000-bbl. daily refinery of Canadian Oil Companies, Ltd. Construction will start this fall on the 4,400-bbl. reformer, which will produce charge stock for the 3,650-bbl. Udex plant. Completion is expected in August 1957.

The Udex plant is to be the first in Canada for extracting chemically pure benezene, toluene, and xylene from petroleum.

MONTREAL. — Shell Oil Co. of Canada is planning a $3 million, dual-purpose petrochemical plant adjacent to its 45,000-bbl. refinery in Montreal East. The plant will make synthetic dodecyl benzene, a prime base for synthetic detergents, and will have facilities for making motor alkylate.

The plant will take raw stocks from the Shell refinery, where projects this summer are adding 10,000 bbl. daily in new crude capacity, 13,000 bbl. daily in vacuum capacity, a 6,600-bbl. Platformer, and a 7,500-bbl. hydrodesulfurizer.

LOS ANGELES.—Work has started on General Petroleum Corp.'s $100,000 expansion of natural-gasoline plant facilities at Santa Fe Springs. Three additional compressors and an increase in absorption and cooling capacity are being built.

G.P.'s recent deeper-pool discovery at Santa Fe Springs field is making the expansion necessary to handle the increased oil production.

NEW YORK.—The Texas Co. is making a direct expansion into petrochemicals. It plans an ammonia plant of 180-tons daily capacity at its Lockport, Ill., refinery. The plant also will have facilities for converting most of the ammonia to nitrogen solutions for fertilizer. Operations will start late in 1957.

The ammonia plant will use hydrogen from catalytic reforming operations of Texaco's nearby refinery.

VANCOUVER, B. C. — Imperial Oil, Ltd., is asking for bids on a $4 million expansion program at its nearby Ioco refinery. Processing units planned include a 5,000-bbl. per day Powerformer, a prefractionator, and a Hydrofiner.

Other projects include new tankage, piping, fire-protection equipment, roads, and special handling facilities for catalyst. Initial operation is set for next summer.

DELAWARE CITY. — Tidewater Oil Co.'s new 5,000-acre refinery site has yielded its first production—but it was garden peas, not gasoline.

The company has leased 3,100 acres around the 130,000-bbl. refinery proper to a major grower who will raise peas, beans, corn, and grain right up to the refinery gates.

DENVER.—A new vacuum unit for asphalt production at the Sheboygan, Wis., refinery of Empire Petroleum Co., Denver, has gone on stream. The 5,000-bbl. daily plant was acquired through merger of Wisconsin Oil & Refining Co., Inc., into Empire last January.

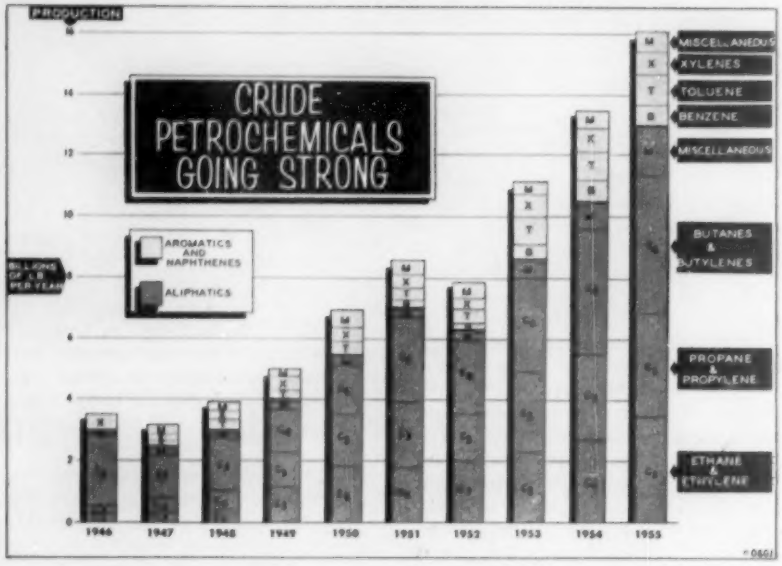
Ethylene Paces Petrochemicals Growth

ETHYLENE was the star last year among the basic petrochemicals.

While the entire list reflected the continued growth pattern of 20 per cent over the previous year, the light paraffins and olefins increased their share of the total volume of crude chemicals from petroleum and natural gas.

According to the U. S. Tariff Commission's preliminary survey, the total production of these basic chemicals topped 16 billion pounds for the first time. Of this output, the aliphatics comprising mainly ethylene, propane, propylene, butadiene, butanes, and butylenes led the list and represented a higher fraction than in the past.

Ethylene, with a 30 per cent increase over 1954, underscored the fact that this established building block is not slowing up at all. With increased production slated for such large-tonnage chemicals as polyethylene, tetraethyl lead, and others it appears that no tapering off is in sight for this versatile petrochemical basic.



Butadiene keeps growing . . . Butadiene was another fast mover last year, reflecting the resurgence of the synthetic-rubber industry under private ownership. On a smaller scale, isobutane made strides, rising in chemical end use from 250 to nearly 445 million pounds in 1955.

The propylene polymers are attracting some interest, as reflected from their steady growth last year. Dodecene, or propylene tetramer, has more than doubled in 2 years, with the steadily increasing demand for low-cost, mass-produced synthetic detergents. Propylene trimer, or nonene, moved upward 50 per cent in output last year, with the new interest in nonionic detergents and other end products.

Newcomer enters picture . . . The 1955

Crude Products From Petroleum and Natural Gas for Chemical Conversion

(Thousands of pounds per year)

	1955 (Prelim.)	1954	1953	1952	1951
Aromatics and Naphthenes:*					
Distillates and solvents	642,649	520,286	404,545	391,263	432,139
Benzene	722,650	673,715	462,105	255,730	234,521
Cresylic acid, crude	24,470	21,576	16,080	14,317	20,386
Naphthenic acids	16,687	23,666	23,123	19,319	38,528
Toluene	1,038,290	889,687	836,473	463,650	403,327
Xylenes, mixed	699,455	726,041	749,010	443,804	464,416
Other cyclics†	30,404	19,037	14,355	17,038	5,190
Total aromatics	3,174,605	2,874,008	2,505,691	1,605,121	1,598,507
Aliphatics:					
Methane	131,527	44,036			
Ethane	445,214	355,820	144,623	203,179	1,798,915
Ethylene‡	3,048,225	2,344,644	2,135,740	1,809,495	
Propane	2,007,140	1,675,124	1,366,175	580,139	973,561
Propylene and C_3 mixtures	1,331,475	1,203,501	1,222,622	996,282	1,148,454
1,3 Butadiene	1,411,285	808,731	1,152,197	1,106,445	1,222,411
n-Butane	753,461	941,088	418,144	37,856	1,136,188
Butylenes§	1,171,596	1,214,756	906,732	825,171	
Isobutane	444,532	250,055	155,589		
Isobutylenes	124,562				
Other C_4s¶	663,748	852,640	534,507	404,178	460,842
C_5 hydrocarbons‖	250,752	179,395	122,048	15,401	
Di-isobutylene		21,997	23,157	25,325	21,670
Dodecene (propylene tetramer)	371,948	316,337	176,926	114,983	93,510
Nonene (propylene trimer)	146,204	98,557	60,986		
Other hydrocarbon derivatives**	8,128	5,331	2,681	1,920	
Other aliphatics††	694,560	259,604	219,242	141,409	152,804
Total aliphatics	13,004,357	10,571,616	8,641,369	6,261,783	7,008,355
Grand total	16,178,962	13,445,624	11,147,060	7,866,904	8,606,862

*The chemical raw materials designated as aromatics are in some cases identical with those obtained from the distillation of coal tar. However, the statistics given in the table relate only to materials derived from petroleum and natural gas. Statistics on aromatic chemicals from all sources will be given in a later report in this series covering "Tar and Tar Crudes."

†Includes data for motor grade benzene, 1,4-methane-2, 5-cyclopentadiene, mixed pyridines, sodium carbolate and phenate, and hydrocarbon polymers.

‡Includes a small amount of ethylene from coke-oven gas.

§The statistics represent principally the butene content of crude refinery gases from which butadiene is manufactured.

¶Includes data for 1-butene, 2-butene, butane-butylene, and butadiene-butylene fractions and mixed olefins.

‖Includes data for pentanes, pentenes, isoprene and mixtures.

**Includes data for di-tert-butyldisulfide, miscellaneous mercaptans, and aliphatic acids.

††Includes data for acetylene, di-isobutylene, hexanes, heptanes and heptenes, octanes and octenes, polybutene, eicosane, and hydrocarbon mixtures.

Source: U.S. Tariff Commission.

survey added isobutylenes to the list.

It also reflects a growing interest on the part of the chemical industry in the higher molecular weight fractions produced by natural-gasoline manufacturers and refiners. The general listing of miscellaneous aliphatics, which includes such chemicals as acetylene, diisobutylene, and the heavier fractions in the C_6 to C_8 ranges shows a 170 per cent jump over 1954 output.

Among the aromatics and naphthenes, there were few surprises. Distillates and solvents, which are mixtures of these cyclic compounds, continued their steady climb in chemical use. Toluene moved upward 17 per cent while benzene showed only a moderate gain of 7 per cent over 1954. Both xylenes and naphthenic acids declined in output last year.

The chart shown here illustrates the general increase in all types of crude petroleum chemicals which find end uses in chemicals.

Propylene blossoms out . . . Propylene is one petrochemical basic which is just now coming into its own. The basic production as propylene alone is not the whole story, since it goes into the propylene polymers which are showing substantial gains. With the new research into polypropylene, it may be expected that this particular basic will gain added attention in the next few years.

Refiners are facing the need to separate and synthesize certain high-octane isomers in the pentane and heavier paraffins as gasoline quality rises during the next few years. This may well provide the petrochemical industry with a growing source of specific hydrocarbon isomers of higher molecular weights than the workhorses of today's petrochemical industry. While the C_3 and C_4 hydrocarbons are expected to hold their own, more attention may well be directed to these heavier fractions over the next several years.

The Tariff Commission report covers basic petroleum fractions which are converted into organic chemicals. It does not include the billions of cubic feet of natural gas, for example, which go into synthetic anhydrous ammonia, the hydrogen sulfide from petroleum and gas fractions which is recovered as sulfur, or the other basics which wind up in the markets as inorganic chemicals.

In this respect, the data on methane is believed to show only part of the total petrochemical picture. Methane was first reported as a separate item in 1954. The volume shown for 1955 is three times as large as for the previous year, but the figures may be misleading if some reporting companies fail to show methane as such, used in the manufacture of chemicals.

watching WASHINGTON

. . . with Bertram F. Linz

FPC orders intervenors to show cause . . .

NONGAS interests intervening in cases before the Federal Power Commission hereafter will have to show that they have a direct competitive interest.

Such a showing, the FPC says, is necessary for it to get a full record of the interest of, and possible injury to, intervenors.

In an earlier court case the FPC sought to have an appeal of the National Coal Association dismissed because the record did not show it was adversely affected. But the court held it was up to the commission to see that evidence on that point was put into the record.

Pipelines intervening in FPC cases normally base their actions on a showing of competitive injury. Coal, railroad, labor and other interests have not in the past ordinarily made such a showing in detail.

The FPC marked its new policy by overruling an examiner who had refused to subpoena interests opposing conversion of the Little Inch line from gas to oil by Texas Eastern Transmission Corp. The commission ordered that the coal, labor, railroad, pipeline and barge interests taking part in the case be required to submit all records relating generally to the competitive fuel situation.

No intervenor should have the power to prevent development of a proper record, the FPC said, and anyone with an interest which would be adversely affected, should present all the facts to support his claim.

New dispersal directive sets off row . . .

NEARLY 50 per cent of the petroleum industry's refining production is concentrated in 10 industrial centers which would be the likeliest targets for an atomic attack. The same situation prevails in many other industries.

Last month the Senate decided to do something about it. It wrote a provision into the Defense Production Act stating the policy of Congress to be "the encouragement of geographical dispersal of industrial facilities."

There was nothing new in that statement. In effect, it was simply the policy now followed in granting quick tax writeoff for new oil and other essential facilities. But the Senate then went a little further. It said the policy also should be applied by military and civilian departments in awarding contracts. That set off quite a row, although the Senate specified it should not preclude the use of existing plants.

California and New England senators particularly opposed the whole provision. They charged it would result in "industry grabbing" by states that had nothing to offer but remoteness from present target areas. They said it would lead to location of plants without due regard to labor, water, transportation, market, and other factors.

Several earlier attempts to write a similar clause into the act have been defeated. This time the luck changed. The Senate approved the provision, 48 to 13. Now the issue is before a conference committee which is ironing out the differences between Senate and House on a number of matters.

Lawmakers scurry to limit "good faith" . . .

SMALL-BUSINESS supporters in the Senate are making a fast drive to get a limitation on the good-faith defense to the floor for a vote before adjournment.

The bill, which would overturn the Supreme Court decision in the "Detroit" case, was passed by the House last month, 393 to 3.

Bobtailed hearings have been held before a judiciary subcommittee headed by Sen. Estes Kefauver of Tennessee, author of the Senate version, in an effort to rush the bill through. Supporters predict that if it reaches the floor it will pass.

Alcohol Bill Dead for 1956

WASHINGTON. — There will be more talk in Washington this week about the advantages of mixing alcohol and gasoline, traffic safety experts to the contrary.

A Senate agricultural subcommittee will approach the matter solely from the angle of motor fuel, however. It will hold a hearing on a bill by Sen. Homer Capehart of Indiana to set up a $100,000,000 "crash" program of research on new uses for surplus farm crops.

The hearing July 7 will be the sum total of action this year on Capehart's bill. Congress will adjourn in a matter of days. Time is lacking in which to get the measure through both houses and follow it up with a second bill providing the money.

When the Eighty-fourth Congress goes out of business, Capehart's bill, along with thousands of other measures not acted upon, will die. If Congress is to set up any program of farm research, the bill will have to be reintroduced next session.

Panacea for farmers . . . The Capehart bill, co-sponsored by 38 other Republicans, was offered last March as a panacea for the farmers' ills.

It called for research, field studies, experiment, pilot plants, and even operating manufacturing plants to prove the commercial feasibility of volume production of motor fuel, rubber, and other products from surplus grain.

These new industries would make acreage limitation unnecessary. In fact, they would induce farmers to work every possible acre, Capehart said. New industries would be created and demand on present ones increased. Retail business would boom. Taxes could be eased because it would no longer be necessary to subsidize farmers.

Opponents said the bill, except for the money to be spent, didn't call for anything that couldn't be done by the Agricultural Department under previous legislation. Anyhow, it was a Republican bill in a Democratic Congress in an election year, so the issue never came up for debate.

Refiners, Jobbers Like Good-Faith Law

WASHINGTON. — Independent refiners and jobbers are fighting any change in the good-faith provision of the Robinson-Patman Act.

They told Sen. Estes Kefauver of Tennessee, chairman of a judiciary subcommittee, that the House-approved bill restricting the good-faith defense in price cutting would put a squeeze on jobbers and "drive another nail in the coffin of the small refinery."

The small refiners are practically unanimous in opposing any overturn of the Supreme Court decision in the Detroit case involving Standard Oil Co. (Ind.). The court held in that case that a company may cut its prices if it's a move in good faith to meet competition.

Donald C. O'Hara, appearing for the National Petroleum Association and Western Petroleum Refiners Association, told Kefauver that all 47 of 85 refiners who responded in a quick survey saw the bill as a threat.

O'Hara pointed out that refiners doing interstate business compete often with refiners who limit their operations to their own states, and are not subject to the Robinson-Patman Act.

In such cases, O'Hara said, a refiner may lose a customer because of a lower price offered by a competitor. If he meets that price he runs the risk of liability for violation of the law. But the intrastate competitor who offered the lower price is exempt from the law.

O'Hara charged that the bill to restrict the good-faith defense is part of an effort to deal with the relations between retail dealers and their suppliers. But the Federal Trade Commission has held that the Detroit case decision did not cover discounts granted to dealers during price wars.

The dealer-discount situation is now before the courts, O'Hara testified. "I think it is obvious that there is no compelling reason to pass a law reversing a decision of the Supreme Court to take care of cases that are not covered by the court's decision," he said.

Expansion Loan Sought

SALT LAKE CITY. — Mountain Fuel Supply Co., Salt Lake City, has asked the Utah Public Service Commission for permission to borrow $12,000,000 from a bank to pay for an expansion program. Wyoming authorities already have approved.

Funds would be used to add to the firm's gas-transmission system, including a 38-mile, 20-in. line from southwestern Wyoming to Utah to transport gas purchased from Pacific Northwest Pipeline Corp. A new compressor station would be built near Granger, Wyo.

Crude Record Looms

Alberta nominations reach new monthly high for July

CALGARY. — July nominations for Alberta crude have set a new monthly record. Refineries are asking for 444,385 bbl. daily during the month.

But 38,000 bbl. daily of this total is a question mark. That amount was nominated for Shell Oil Co.'s 50,000-bbl. Anacortes, Wash., refinery on the condition that the 13-week-old strike there is settled. If the strike continues, total nominations will be cut to 406,385 bbl.

United States refineries, including Anacortes, have asked for daily-average deliveries of 112,455 bbl. These refineries and their nominations are:

Shell Oil at Anacortes, 38,000 bbl.; General Petroleum Corp. at Ferndale, Wash., 14,887; Texaco Exploration for General Petroleum at Ferndale, 11,613; International Refineries at Wrenshall, Minn., 11,290; Great Northern Oil Co. at Pine Bend, Minn., 7,000; Northwest Refining Co. at St. Paul Park, Minn., 5,000; Bay Refining Corp., Bay City, Mich., 3,000; West Branch Refineries, Inc., West Branch, Mich., 1,130, and Union Oil Co. of California at Cut Bank, Mont., 225.

Interprovincial pipeline is scheduled to move a daily average of 202,140 bbl. of this into the East and Trans-Mountain 163,605 bbl. to the West.

Top purchaser during July will be Imperial Oil, Ltd., with 172,965 bbl. daily.

Jalco Sells Westpan Stock

DALLAS.—Jalco, Inc., of Dallas has sold its 67.8 per cent interest in Westpan Hydrocarbon Co., Amarillo, to oil and insurance companies for about $5.4 million. Jalco only last May had acquired 53 per cent interest in Westpan from Sinclair Oil Corp. for $4.8 million.

An undivided 80 per cent of the Jalco holdings went to Christiana Oil Corp., Beverly Hills, Calif. The other 20 per cent interest was sold to Northwestern Mutual Life Insurance Co., Milwaukee. But this share is subject to a reserve interest sold by Jalco to Barlu Oil Corp., Dallas. This sale was financed through a $4.7 million loan from Northwestern to Barlu.

Westpan holds liquid hydrocarbon reserves in the West Panhandle gas field of Texas. Most of the liquids are recovered by Colorado Interstate Gas Co. They are marketed in the north Panhandle area by Christiana, primarily to Phillips Petroleum Co. and Sinclair Oil & Gas Co.

Aneth Oil Marketed

2,000 bbl. daily taken from new field by Utoco

SALT LAKE CITY.—The Texas Co. has found a market for 2,000 bbl. daily of its production in the important Aneth field of San Juan County, Utah.

Texaco has signed an agreement with Utah Oil Refining Co. here to take the shipments. Crude will be trucked to railhead at Thompson, Utah, and moved then by rail to Utoco's plant.

The arrangement will require purchase of a similar amount of Wyoming crude by Texaco. This may be substituted later with some crude from areas other than Wyoming.

Only previous market for Aneth crude has been the El Paso Natural Gas refinery at Pruett, N.M., at the rate of 130 bbl. of oil per day per well. Texaco now has four wells completed at Aneth with little actual production history on them.

With the new marketing deal, it plans to rotate production among the wells to determine production characteristics.

Most oil observers consider Aneth the major discovery in the Rocky Mountain region this year. The discovery well was completed for 1,704 bbl. daily from the Paradox. All subsequent wells have averaged above 1,500 bbl. daily with average depth about 5,800 ft. The crude is 43°-gravity with low sulfur content.

Triple Completion Planned

AUSTIN, Tex.—Amerada Petroleum Corp. plans a triple completion in one of its wells in Olivia field of Calhoun County on the Texas Gulf Coast.

The company now has an application before the Texas Railroad Commission to carry out the project. If the commission goes along, the Amerada well will become the first triple completion in Texas.

The well is Amerada's 1 State T "D." The company wants to produce the three zones through the casing-tubing annulus and two strings of tubing.

The three reservoirs are the Upper and Lower 7,500-ft. sands and the 8,300-ft. sand. The Upper 7,500-ft. sand is perforated from 7,817-21 ft. and would be produced through the annulus. The Lower 7,500-ft. sand, perforated from 7,832-38 ft., would be produced through the short string of tubing. And the 8,300-ft. zone, perforated between 8,650-54 ft. would produce through the long tubing string.

All three reservoirs in the field are already being produced in various combinations through dually completed wells. And Amerada has waivers to try the triple completion from all offsetting operators.

The company also asked the commission to permit it to set the long string of tubing to the 8,300-ft. zone 100 ft. higher than normally required to allow plenty of room for remedial work below the tubing.

Radio Jam May Ease

More channels would help oil industry mobile users

WASHINGTON. — Oil companies using mobile radio may see the traffic jam on their channels eased soon.

The Federal Power Commission has announced that all television stations gradually may be moved to ultra-high frequencies. Such a move would free valuable channels in the very-high-frequency bands used by mobile radio operators.

Television channels most likely affected are those numbered 2 through 6. These channels require a total of 30 megacycles of spectrum space below 100 megacycles. Moving them to an ultra-high-frequency band would make available 1,500 channels for other radio service. Many would go to the petroleum industry.

Oil companies are sorely in need of more channels for mobile-radio service. The most crowded petroleum band is between 45 and 50 megacycles. This is a particularly good frequency for long distance VHF radio. But serious overlapping and interference exist between many separate licensees.

Britain Gets 100-Octane

One-hundred octane gasoline is hitting the market this month in Britain, where competition for the premium-gasoline trade is as vigorous as in the United States.

BP Super Plus, with a 100-octane rating, will be marketed by Shell-Mex & B.P., Ltd. The firm is the joint distributing company in England for British Petroleum and Royal Dutch-Shell groups.

Competitors of Shell-Mex quickly answered the 100-octane announcement with large advertisements in London papers.

Regent Oil Co., which sells Regent and Caltex products, said it will offer a "premium plus" gasoline surpassing all previous standards. It mentioned no octane rating.

Esso Petroleum Co., while not suggesting a new product, indicated future improvements.

Lease Sale Slighted

Tidelands parcel offered under new California law

LOS ANGELES. — California's first tidelands parcel offered for lease under a new state law attracted only two bids. The sale covered 500 acres off Summerland in Santa Barbara County.

Tidewater Oil Co. submitted the high bid with a cash bonus offer of $75,166.70. Only other bidder was Tecolote Oil Co., which made a $5,000 offer.

The staff of the State Lands Commission will meet with the commission in Sacramento this week with a recommendation on whether either of the bids will be accepted.

Under law, the commission has the right to reject all bids if it feels none are in the public interest.

Drilling Program Speeded

SALT LAKE CITY. — Northwest Production Co., operating affiliate of Pacific Northwest Pipeline Corp., plans to drill 28 wells this year in Rio Arriba County, New Mexico, with completion scheduled in the Pictured Cliffs formation.

The program is part of a large-scale development project aligned with completion this year of the Pacific Northwest pipeline from the San Juan basin on the Colorado - New Mexico border to Washington State.

Pacific Northwest acquired large acreage in the San Juan basin more than a year ago and since then has been carrying on an intense development program.

Pipeline Project Advancing

REGINA.—Work is moving rapidly on Saskatchewan Power Corp.'s $2,000,000 pipeline system which will serve central and southern sections of the province.

Moose Jaw and Swift Current will be tied in this year to Success gas field. A 120-mile, 10-in. transmission line will provide a market outlet which, in about 2 years, will deplete the field's reserves. Then the communities may be served by gas from Trans-Canada, and the Success wells can be used for underground storage during off-peak periods.

Work is well advanced on the Swift Current section. Construction on the system at Moose Jaw started last week. Pipe for the main transmission line from Success is expected to start arriving momentarily.

Crude Flow Levels Off

Steady free-world production changes downward pattern set for April in past 2 years; but U. S. output drops

CRUDE production in the free world outside the United States in April remained at virtually the same level as the preceding month. Output averaged 7,715,200 bbl. daily, a comparatively small gain of 1,400 bbl. daily.

United States output averaged 7,146,000 bbl. daily, off 132,000 bbl. daily from March, the lowest level since January. This brought total free world production to 14,861,200 bbl. daily.

The steady level of production in free areas outside the United States was a change from the pattern of the same month during the past 2 years. In April 1955, over-all output was down 81,900 bbl. daily, and in 1954, off 219,600 bbl. daily.

Production in Venezuela was the lowest since December, down 78,300 bbl. daily to 2,313,700 bbl. daily. It also was off 32,200 bbl. daily from the 4-month average of 2,345,900 bbl. daily.

The decline in Venezuela was offset by a new high of 3,736,600 bbl. daily in the Middle East, up 112,300 bbl. daily, or 3.1 per cent from March.

New Kuwait record . . . Kuwait paced production in this area of the world with a record output of 1,242,200 bbl. daily from its approximately 175 flowing wells. The shaikdom's volume of crude was up 67,100 bbl. daily over March, and 34,300 bbl. daily more than the previous record, which had stood since May 1955.

Saudi Arabian output also reached a new high, up 45,100 bbl. daily to 1,054,100 bbl. daily, beating the November 1955 record by 13,000 bbl. daily. Consortium production in Iran reached a new level, rising 37,300 bbl. daily to 576,000 bbl. daily. Qatar, which has a relatively stable output, had a record 126,200 bbl. daily, up 1,100 bbl. daily.

Iraq was the only Middle East country having a decline. Its output of 677,800 bbl. daily was down 38,000 bbl. daily.

Among the smaller producing countries, West Germany's 66,500 bbl. daily output was a record. Production from the country's intensely developed fields rose 2,000 bbl. daily, the greatest increase in 16 months.

Output in Egypt rose 100 bbl. daily due to an increase of 900 bbl. daily in International Egyptian Oil Co., Inc., production. This offset a decline in fields operated by Royal Dutch-Shell and Socony Mobil Oil Co., Inc., companies.

International Egyptian output averaged 5,100 bbl. daily from its new Belayim and Feiran fields in Sinai Peninsula. The company expects to develop 20,000 bbl. daily production by the end of the year.

Report from Soviets . . . A Soviet observer at a Geneva conference recently reported a firm production figure for Russia on a daily basis, information about which the Reds have been tight-lipped.

He said that Russia was producing over 210,000 tons daily toward the end of 1955, or about 1,500,000 bbl. daily. He added that in 1960 Soviet output would reach 410,000 tons daily, or nearly 3,000,000 bbl.

TREND OVER THE LAST YEAR

1955—	Western Hemisphere less U.S.	Middle East	Total, non-Communist countries
April	2,982.8	3,290.8	6,786.4
May	2,932.1	3,287.4	6,718.8
June	3,019.7	3,201.6	6,720.9
July	3,092.7	3,275.8	6,872.1
August	3,140.4	3,243.0	6,978.2
September	3,130.9	3,256.9	6,990.7
October	3,179.6	3,378.2	7,166.0
November	3,255.0	3,386.0	7,248.3
December	3,298.5	3,316.1	7,227.2
1956—			
January	3,363.7	3,392.6	7,368.5
February	3,426.2	3,415.7	7,453.4
March	3,471.2	3,624.3	7,713.8
April	3,357.3	3,736.6	7,715.2

World-Wide Crude Production

(Daily average in thousands of barrels)

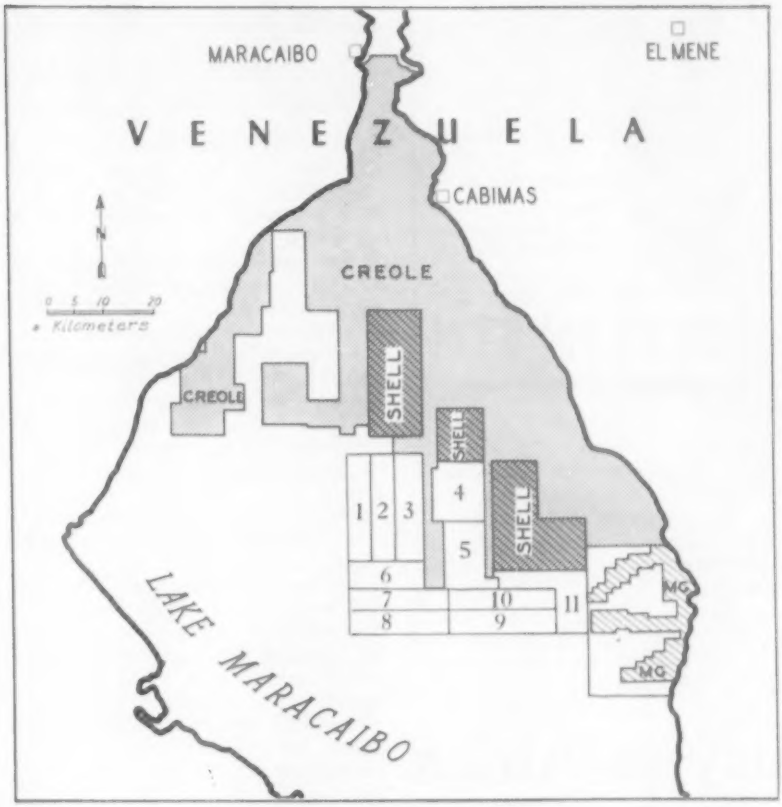
Country—	April 1956	March 1956	April 1955
W. Hemisphere:			
Argentina	84.0	84.0	81.4
Bolivia	8.2	8.2	4.5
Brazil	7.5	7.0	5.4
Canada	415.0	461.2	252.8
Chile	9.2	9.2	6.3
Colombia	118.9	119.2	105.2
Cuba	1.6	1.5	0.9
Ecuador	9.8	9.8	9.1
Mexico	265.0	255.8	259.0
Peru	48.9	47.8	47.8
Trinidad	75.5	75.5	64.3
Venezuela	2,313.7	2,392.0	2,146.1
Total	3,357.3	3,471.2	2,982.8
W. Europe and Africa:			
Algeria	0.8	0.8	1.1
Fr. Morocco	2.0	2.0	2.3
Egypt	38.2	38.1	33.3
Austria*	64.7	64.7	...
France	23.8	23.8	15.1
W. Germany	66.5	64.5	59.5
Italy	9.0	9.0	3.2
Netherlands	20.1	19.2	19.5
Turkey	5.5	5.5	2.4
United Kingdom	1.2	1.2	1.1
Yugoslavia	5.1	5.1	4.8
Total	236.9	233.9	142.3
Midle East:			
Bahrain	30.0	30.0	30.0
Iran†	576.0	539.0	289.0
Iraq‡	677.8	715.8	678.7
Israel	0.3	0.3	
Kuwait	1,242.2	1,175.1	1,179.3
Neutral Zone	30.0	30.0	21.4
Qatar	126.2	125.1	113.4
Saudi Arabia	1,054.1	1,009.0	979.0
Total	3,736.6	3,624.3	3,290.8
Other Asia:			
British Borneo	113.0	113.0	103.7
Burma	5.2	5.2	4.0
India	7.5	7.5	7.0
Indonesia	240.0	240.0	234.0
Japan	6.0	5.9	5.9
New Guinea	7.0	7.1	10.1
Pakistan	5.7	5.7	5.8
Total	384.4	384.4	370.5
Total Free World Foreign	7,715.2	7,713.8	6,786.4
United States	7,146.0	7,278.0	6,887.0
Total Free World	14,861.2	14,991.8	13,673.4
Communist Countries in Soviet Orbit:			
Russian Zone of Austria*	...	...	68.7
Romania	150.0	150.0	125.0
Russia	1,500.0	1,500.0	1,235.0
Others	50.0	50.0	36.8
Total	1,700.0	1,700.0	1,465.5
World total	16,561.2	16,691.8	15,138.9

*Austria took over its producing fields from Russia in August 1955.

†Includes an estimated 4,000 bbl. daily from Naft-i-Shah field not operated by consortium.

‡Includes 3,800 bbl. daily in March and April and an estimated 12,000 bbl. daily in April 1955 from Naft Khaneh field, operated by British Petroleum Co., Ltd., rather than I.P.C.

Figures are from reliable reports in the industry or official government sources. Data for Russia and eastern Europe are based on competent estimates; no authentic information is available on month-to-month production in these areas. Estimates also have been made for other countries, particularly in Southeast Asia, where completely current reports are lacking. Communist countries in the Soviet orbit includes satellite countries in Europe and Red China.



Venezuelan Tracts Sold

● Mene Grande dominates first Venezuelan leasing in 11 years; competition hikes bonuses to almost $200 million

VENEZUELA has granted at least 8 of the 11 highly prized 10,000-hectare exploitation concessions in Lake Maracaibo, according to unofficial reports from Caracas last week.

Reports were that the tracts, the first granted by the Venezuelan Government in 11 years, brought between $188,000,000 and $195,000,000. Bids were understood to range from 7,500 bolivares per hectare ($906 per acre) to more than 9,300 bolivares ($1,133 per acre). That is roughly double the 4,000-bolivar minimum set by the government for final bids which were received June 9 *(The Oil and Gas Journal, June 11, page 100)*.

There was no official government announcement late last week. But the reports from Venezuela were that the successful bidders were called to the Ministry of Mines and Hydrocarbons and informed orally that they had made satisfactory offers.

The reports indicated that six of the exploitation concessions of 24,710 acres each went to Venezuela's "Big Three." Two more went to combines of smaller United States oil companies, some of them newcomers to Venezuela. Three of the blocks were not sold.

Here is a breakdown of the companies and their acreage, according to the unofficial report which companies themselves refused to confirm or deny in the absense of a government statement:

... **Mene Grande Oil Co.** (Gulf) received four of the lake blocks, or a total of 98,840 acres. With 2,419,843 acres already under concession in Venezuela, Mene Grande has some lake acreage slightly south and to the west of the old Mene Grande field (see map).

Other successful bidders, with one 24,710-acre tract each:

... **Creole Petroleum Corp.** (Jersey Standard). Creole is Venezuela's largest producer with more than 1,055,000 bbl. daily. The company already has 2,770,851 acres under concession in the country and has more Lake Maracaibo acreage than any other operator.

... **Cia. Shell de Venezuela.** Shell ranks second only to Creole as a Venezuelan producer, with a daily average of about 687,000 bbl. The Shell company has 188,031 acres under concession, including extensive holdings in the lake. Some of its acreage is adjacent to the newly opened area.

... **A two-company combine** of Sun Oil Co. and Atlantic Refining Co. This marks Sun's debut in Venezuela. It underscores the new policy of the traditionally domestic company, a heavy crude buyer, of looking abroad to increase its reserves. Venezuelan Atlantic Refining Co., a wholly owned subsidiary of Atlantic, has 722,595 acres under concession and produces more than 20,000 bbl. daily.

... **A four-company combine** of Signal Oil & Gas Co., Hancock Oil Co., Sohio Petroleum Co., and Pure Oil Co. None of the four has acreage in Venezuela. They were willing to pay a high price to enter the fabulous lake play. It was reported in excess of $1,100 per acre, or $28 million, by far the highest bid on any of the 11 blocks offered.

Competition for the blocks was spirited. Much of the acreage is semi-proved, some of it actually adjoining Creole and Shell production. The established companies were as eager to expand their operations as newcomers were to get a toehold in Venezuela, and their desire was whetted by a decade of waiting.

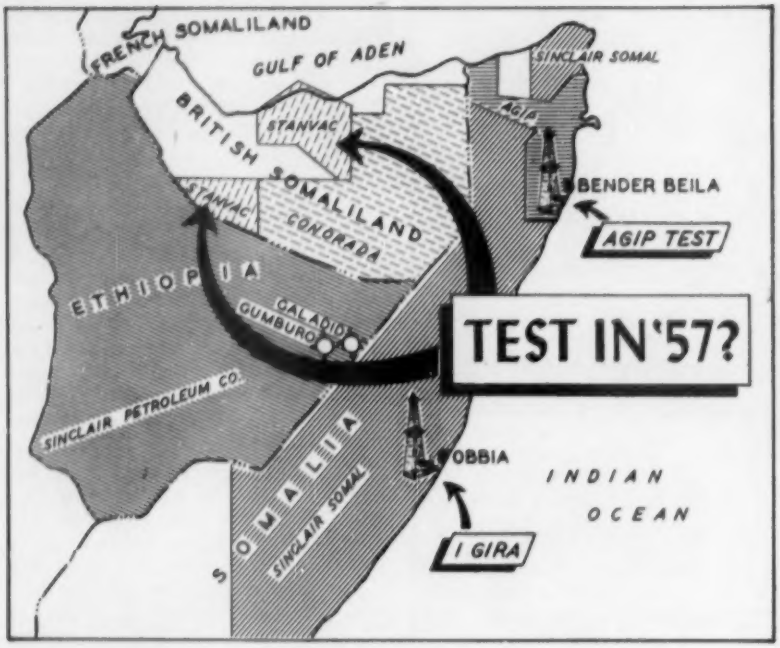
The situation shot bids sky high, well beyond the reach of many companies which are now watching for the government's next move.

What next? ... The lake leasing could lead to others in virgin exploration areas.

What everyone is interested in now is (1) whether these three blocks will be reoffered, and (2) when additional Venezuelan areas will be opened.

With oil comprising 80 per cent of its income Venezeula would like to expand its production base. The big lake sale fattened the treasury a good deal, but Venezuela could use still more revenue. Output now is 2,392,000 bbl. daily and rising, but it comes from decreasing acreage as operators give up half their concessions in turning to development.

When the new areas are opened, they will not lack bidders. Five-sixths of Venezuela's sedimentary basin area remains untested. Applications for permission to explore 27,452,340 hectares were filed last year by oil companies. The results of this preliminary prospecting will be the basis for future bids when the government grants new concessions.



New wildcat spudded as . . .

. . . Drill Busy in Africa

EXPLORATION on Africa's eastern bulge is increasing in tempo.

Latest move in the stubborn region is Sinclair Somal Corp.'s 1 Gira, a wildcat spudded June 21 about 27 miles west of the Indian Ocean coastal town of Obbia.

The deep test is located on a 56,000,000-acre concession which covers nearly half of Somalia. A small section of the acreage in northern Somalia is separated from the main middle-Somalia holdings by an 11,000-sq.-mile strip held by Azienda General Italiana (A.G.I.P.).

Sinclair Somal holds 50 per cent interest in the giant concession. The remaining 50 per cent is held by Amerada Petroleum Corp., Continental Oil Co., and Ohio Oil Co. *(The Oil and Gas Journal, June 25, page 61).*

Site for the wildcat was chosen after more than 3 years of geological and geophysical work over difficult desert terrain. More than 4,000 tons of equipment and supplies for the test were landed on a beach with landing craft *(The Oil and Gas Journal, March 19, page 134).*

International Drilling Co. is the drilling contractor.

Other activity . . . Some 350 miles to the northeast, Minerara Somalia, a subsidiary of the Italian Government-owned ENI, recently started its first wildcat. The well is 12 miles west of the coastal town of Bender Beila on the A.G.I.P. strip. The company recently added a Rogers Geophysical Co. crew to its Somalia operations.

Meanwhile, in neighboring British Somaliland, northwest of Somalia, geophysical and geological work is progressing on separate concessions held by Standard-Vacuum Oil Co., Inc., and Conorada Petroleum Corp.

Exploration work in Stanvac's two blocks has reached the point where a wildcat test is expected early next year. Conorada has no drilling plans yet, but a test could get under way within 6 months.

Stanvac's concessions total 11,380 sq. miles in British Somaliland. The acreage was formerly held by Moriqui Exploration Corp. of Los Angeles. Conorada's concession there covers 36,000 sq. miles.

Sinclair also has a rig in Ethiopia, where the company holds a concession over the entire country. Two wells have been drilled and suspended. Gumburo 1 went below 10,000 ft. in 1950 and Galadi 1 was suspended below 9,000 ft. in 1953.

The large concession blocks in Somalia, British Somaliland, and Ethiopia are United Nations trust territory, administered by Italy. They nearly blanket the eastern corner of Africa.

Arab Strikes Banned

Tough decree sends workers scurrying back to the job

SAUDI ARABIA last week issued a decree banning strikes and warned that violation of the order could result in imprisonment or banishment from the country.

The move came just a few days after about 20 per cent of the Saudi Arabian employes of Arabian American Oil Co. failed to show up for work.

Aramco officials said all workers returned to their jobs the next day.

The new labor decree, broadcast by a Mecca radio station last week, prohibits any work stoppage brought about by an agreement of three or more persons.

Penalties cover demonstrations, lockouts, and coercion to cause work stoppages.

Aramco officials in the U. S. were inclined to minimize the seriousness of the brief labor flareup. But apparently the Saudi Arabia Government moved swiftly and surely to avoid any interruption of the nation's oil production.

Unofficial reports from that country blamed the walkout on Saudi Arabian worker demands for pay and housing equal to that of Americans.

Aramco officials in New York last week said the "absenteeism" which preceded the Government decree had no effect on company operations.

The company has almost 14,000 Saudi Arabia employes on its payroll. Some 4,000 workers are nationals of other Middle East or Far East countries.

Aramco has had only one serious labor disorder in its more than 20 years of operation in Saudi Arabia. In October 1953, about 13,000 of its employes walked off their jobs in a general strike which shut down all field operations for a short time *(The Oil and Gas Journal, October 26, 1953, page 73).*

Turkish Company Formed

Israel-American Oil Co. has formed a new subsidiary, Marmara Petroleum Corp., to operate in Turkey.

Marmara has been granted four licenses covering 450,000 acres in promising Thrace basin. Seven other companies also received permits in Thrace.

The licenses, still subject to approval of the Petroleum Administration, were issued under the new liberalized Turkish petroleum law for a 6-year period. Leases extend 40 years.

Thrace, on the European mainland, is accessible and close to sources of supply and major Turkish markets.

Husky Oil Co. holds about one-half interest in Israel-American.

Aramco Trying for Deeper Pay Zones

ARABIAN AMERICAN OIL CO. is coring ahead to test other members of the Arab zone at its 1 Kharsaniya wildcat, an indicated major oil discovery near the Persian Gulf Coast of Saudi Arabia.

The rank wildcat, the first on the Kharsaniya structure, is just 2 miles off the 140-mile, 22-in. crude line being built from the Safaniya offshore field to Ras Tanura (see map). It is 19 miles north of Fadhili and 18 miles east-southeast of Abu Hadriya field.

The well tested 2,200 bbl. daily from the upper 22 ft. of the Arab zone, believed to correspond with the "A" member *(The Oil and Gas Journal, June 25, page 83)*. Gravity was 32.4°. The oil had a trace of b.s. and w. and a hydrogen sulfide content of only 30 parts per million, only one-fourth that of Abqaiq crude.

The 1 Kharsaniya tested dry in the Cretaceous sands which are the main pay at Safaniya. This "A" member has produced oil so far only in Damman. It is 400 ft. lower structurally than the equivalent zone in Abqaiq and 1,900 ft. lower than the zone at Damman. Aramco plans to test the Arab "B," "C," and "D" members which are the main pay in Ghawar, Qatif, Abqaiq, and Damman.

These pays account for most of Saudi Arabia's daily oil production of more than a million barrels.

New Wildcat Spudded in Iran

THE first wildcat well to be drilled in Iran since 1951, when the country's oil industry was nationalized, was due for spudding in last week near Ahwaz.

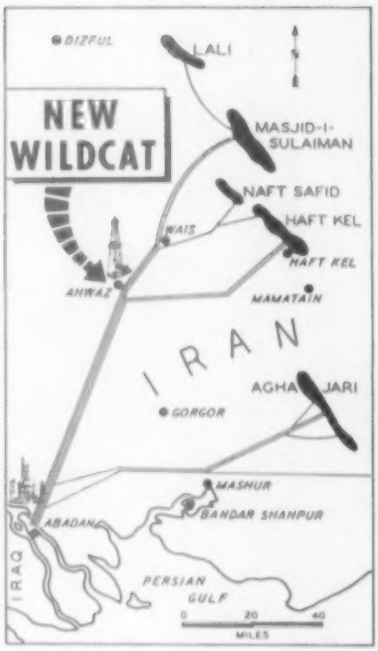
The drilling site is the location of a test which was abandoned by Anglo-Iranian Oil Co. (now British Petroleum Co., Ltd.), when the fields and Abadan refinery were nationalized.

The location is about 40 miles south and west of Naft Safid and nearly 60 miles north and west of Agha Jari. The latter is now supplying almost 75 per cent of Iran's daily oil production of 572,000 bbl.

The Ahwaz wildcat will be drilled by Santa Fe Drilling Co. under contract to Iranian Oil Exploration & Producing Co., one of the two operating companies in Iran under terms of the International Consortium Agreement.

Santa Fe was awarded the contract for exploration and development drilling earlier this year *(The Oil and Gas Journal, May 28, page 105)*.

The drilling firm now has six Americans in Iran, operating with about 40 Iranian nationals, in its drilling crews.



Drilling crews busy . . . The American drilling company started its operation in Iran early this year. It has already completed one development well at Agha Jari at 6,300 ft. and started a second Agha Jari well.

The firm has begun workover operations at Haft Kel, plans future development and drilling at Naft Safid, and will drill a major stepout in an effort to extend Agha Jari's production farther to the northwest.

Limits of this relatively new field, discovered in 1937, are undefined.

In connection with the active drilling program, geological parties are working in the coastal regions of the two extreme southern provinces of Laristan and Kerman in Iran.

If this preliminary search should uncover promising structures, some of the drilling may shift to the south.

French Get New Algerian Show

A NEW oil show in the Reggane region of west central Algeria has been disclosed by the French.

No permit has been granted over the area and reports from Paris last week did not name the company drilling the test. But the block on which it is located is surrounded on three sides by acreage held or applied for by Cie. de Recherches et d' Exploitation de-Petrole au Sahara (C.R.E.P.S.).

The show was encountered at 984 ft. in tight carboniferous sandstone. It is about 180 miles west of In Salah, near where an important gas discovery was made by C.R.E.P.S. in 1954, and 500 miles west of two recent oil discoveries near the Algerian-Libyan frontier.

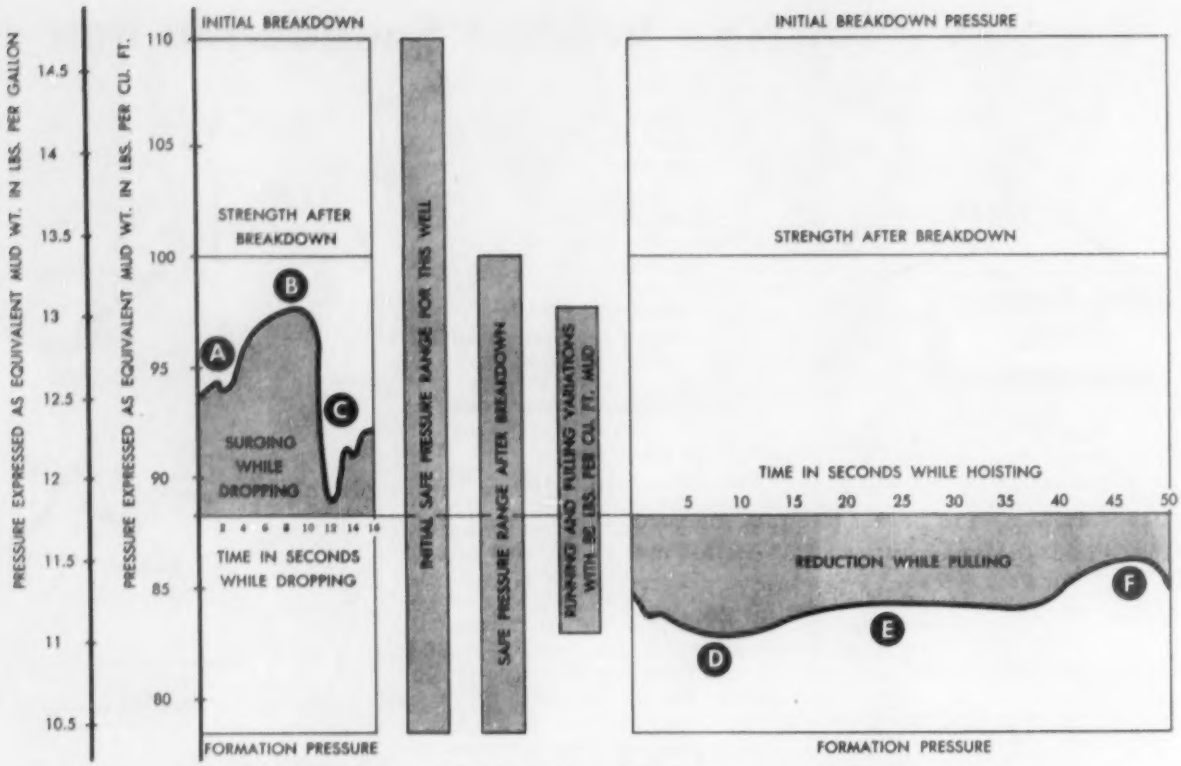
C.R.E.P.S., meanwhile, has received a prospecting permit covering 6,100 sq. miles near In Salah. The company must spend about $1,750,000 for exploration in the 5-year life of the permit.

The 1954 gas discovery by C.R.E.P.S. is 31 miles south of In Salah. It indicated a potential gas flow of better than 17,600,000 cu. ft. daily. The well was drilled on the Djebel Berga anticline. Gaseous sandstone was struck at 4,593 ft. in the Devonian. The test was bottomed at 8,461 ft.

Several core holes have been drilled in the In Salah area, some of which have had traces of gas or oil. Two other deep tests in the vicinity also had small shows of gas and one of them had a trace of oil.

The second strike, Tig Uentourine, was made 40 miles west of Edjele 101, which has tested 19 bbl. per hour *(The Oil and Gas Journal, June 25, page 81)*.

C.R.E.P.S. is owned 35 per cent by Royal Dutch-Shell. Remaining ownership is held by the French.



INSTANTANEOUS VARIATIONS in bottom-hole pressure while running or pulling a stand. Fig. 1.

You Can Reduce Lost-Circulation Problems

Lost circulation may occur because of excessive mud-weight buildup, poor mud conditioning, fast pipe handling, and mud-pump shock pressures. This article shows just what is happening at the bottom of the hole and explains how to minimize loss of circulation during drilling.

by E. H. Clark, Jr.

Part 1

SINCE a high percentage of lost-circulation problems are triggered by pressure surges from pumping or pipe handling, or both, the importance of pressure-reducing practices cannot be overemphasized. This is true particularly when other details, such as muddedoff production zones, wet primary-cement jobs, and stuck drill pipe are compounded with the cost of lost circulation. Rapid pipe hoisting and lowering speeds, which for years have been a symbol of the efficiency of a drilling crew, can well be an important source of drilling and completion problems.

Pressure and Lost Circulation

In any oil well, regardless of the formation, there are certain limits within which the total bottom-hole pressure must be contained to prevent serious problems. The lower limit generally is determined either by hole sloughing problems or by formation-fluid pressures. The upper limit is determined by the formation strength as associated not only with the problem of lost circulation but also with the problem of zonal intermingling due to fractures.

Fig. 1 shows a typical relationship that could exist in a given well among formation pressure, static mud weight, initial breakdown, strength after breakdown, and mud weight variations due to pipe handling. Initially, the static mud weight of this well can vary safely all the way from 78 lb. per cu. ft. (10.5 lb. per gal.) up to 110 lb. per cu. ft. (14.7 lb. per gal.). At pressures equivalent to mud weights less than this, formation fluids or gases will enter the well bore while at values higher than the upper limit, the formation will begin to break down.

Once such a breakdown has occurred, the formation strength invariably will be lowered temporarily, and, in many cases, permanently. Consequently, should any occasion occur wherein the walls of the well are opened up, the allowable bottom-hole pressure is reduced to the area labeled "safe pressure range after breakdown," or reduced to cover only mud weights ranging from 78 lb. per cu. ft. (10.5 lb. per gal.) to 100 lb. per cu. ft. (13.4 lb. per gal.).

Surge effects . . . Static mud weight alone, however, does not describe the

total pressure existing in the well bore. A full description not only includes the static weight of the mud, but also must include the effects of pumping as well as the effects of pressures induced by pipe handling. A typical example of the instantaneous pressure increase and the instantaneous pressure decrease due to pipe handling is shown also in Fig. 1. At left, is the pattern created during lowering of a 90-ft. stand of drill pipe into the well in 16 seconds.

Initially (point A), the pressure is due mostly to the necessity of accelerating the annular fluid mass upward. At the midportion of the cycle (point B), these accelerating pressures are compounded with hydraulic friction losses as the fluid is being rapidly displaced up the annulus. During the latter portion of the cycle (point C), there is a rapid dropoff as the pipe is brought to a stop. This dropoff occurs because the fluid in the annulus is in rapid motion and tends to continue to move up the hole. A rapid application of the brake actually can cause the bottomhole pressure to fall below hydrostatic during this deceleration period.

When the stand is removed, a pressure reduction as shown at the right will occur. Due to horsepower limitations on withdrawal speeds, swabbing reductions in most cases are less than the positive surges of running in the hole, but they still add a sizable value to the variation in the bottom - hole pressure. Reductions are high initially (point D), until the annulus fluid has been accelerated to fill the void created by pipe removal. The reduction then will steady out as the pipe reaches uniform hoisting speed (point E) and

Here's how to forestall the No. 1 problem

The following pressure-reduction practices should be considered as standard procedures, to prevent the first (and most damaging) loss of circulation:

1. INCREASE RUNNING OR PULLING TIMES sufficiently to keep pressures safely above zonal hydrostatic pressure, but below the formation strength at all times.

2. CONTROL THE RATE OF ACCELERATION or deceleration of the pipe through smoother brake handling and earlier use of the hydromatic brake.

3. USE BOTTOM FILL DEVICES (wherever they are feasible commensurate with other problems that might exist) to relieve annulus pressures by internal filling.

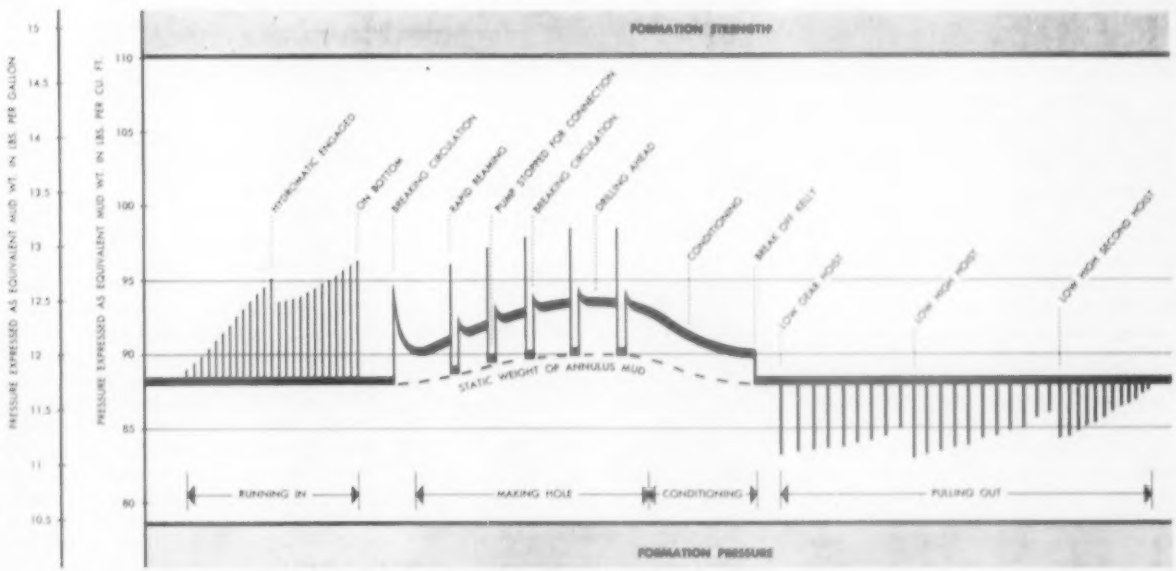
4. INCREASE CLEARANCES wherever possible. (Although this concept is affected by so many other economic factors that the recommendation of changing programs would be inadvisable on this basis alone, there is a point of decreased clearance at which the bottomhole pressures will begin a very rapid upward swing. This should definitely carry some weight along with the other factors determining a given drill pipe, casing, and open hole relationship.)

5. USE CARE IN CHOOSING PROJECTIONS above pipe size. For drill pipe this includes drill collars and oversize drill pipe protectors. For casing these projections include centering and scratching equipment. Such projections can compound pressure buildups, particularly if they should create excessive local pressure losses because of high turbulence and eddies or balling up.

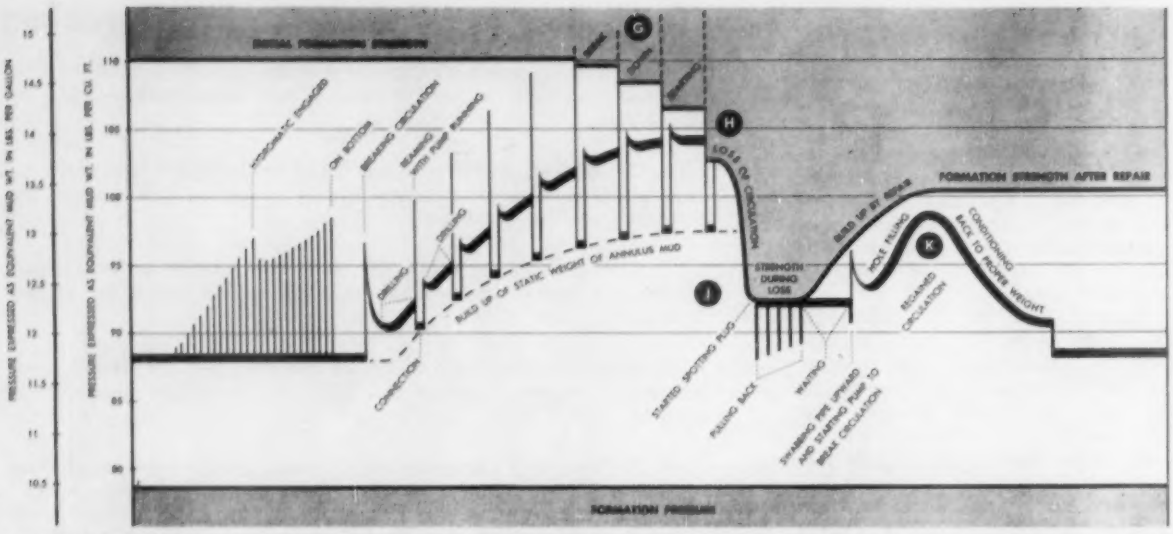
6. USE CARE IN SPUDDING back through previously drilled formations with high rates of pumping as well as high rates of pipe acceleration and deceleration.

7. BREAK CIRCULATION SLOWLY at all times and wherever possible use motion of the pipe to assist in doing so.

8. MAINTAIN ADEQUATE CONTROL over mud properties both in the mud pits and in the well bore.



B.H.P. CHART FOR NORMAL DRILLING CYCLE, with pressure as a function of time. Fig. 2.



B.H.P. CHART FOR LOST CIRCULATION caused by buildup of mud weight in the entire system or buildup in the annulus due to insufficient pump capacity for the penetration rate. Fig. 3.

hold until the engines are slowed. The swabbing is less during the period when the engines are slowing down (point F), since the annulus fluid tends to continue downward and pipeup at the bottom of the hole. The effect in this case is much less pronounced than point C since the slowing of the engines is much more gradual than brake application.

Normal Drilling Cycle

Fig. 1 shows in expanded detail only a few seconds of the total picture. A better concept of the over-all daily variations in bottom-hole pressure may be obtained from Fig. 2. This chart shows the highlights of a typical, normal drilling cycle as it would appear on a pressure recorder from the bottom of a well containing 88 lb. per cu. ft. (11.8 lb. per gal.) mud. Bottom-hope pressures in this illustration again are expressed as the equivalent mud weight, or the instantaneous mud weight which would be required to equal the normal static weight plus the surge pressure.

The cycle begins as the crew starts to lower pipe into the hole. The surges are insignificant initially, but soon begin to increase due to two factors: (1) the length of the path which the escaping fluid must follow is increasing as each stand is run in; (2) the rate at which the drill pipe can be dropped into the hole increases as the additional weight of the string begins to overcome the friction of the blocks, lines, and draw works. At the point marked "Hydromatic Engaged," the hydromatic brake was applied, thus slowing down the joint-dropping times and smoothing out the handling of the pipe. Failure to halt the increasing dropping speeds of the pipe, by this or some other means, will lead to unnecessarily high surges as the last stands are run.

Drilling surges . . . With pipe on bottom, connections are made and pressure is applied to break circulation. The pressure peak which is encountered will depend a great deal on how rapidly the pumps are started as well as on the hydraulic properties of the mud at this time. With the breaking down of the gels and the removal of any wall cake which has been dislodged by the trip in the hole, the circulating pressure falls back to normal and drilling continues.

During drilling there is invariably a buildup of weight in the annulus mud because of the density of cuttings coming off the bottom of the hole. The amount of this buildup is dependent on the hydraulic lifting characteristics of the mud, the pump horsepower available to clean the hole, and the rate of penetration of the bit. Under normal conditions the buildup is inconsequential, since it generally steadies out at 2 to 3 lb. per cu. ft. (0.25 to 0.35 lb. per gal.).

The high peak, noted just before each connection is made, occurs during the reaming of the hole with the pump running. In this condition, the pipe-motion pressures are compounded with pump pressures, and the sum of these two can be rather high if the kelly is spudded off rapidly. Although this practice is dangerous if not properly controlled, it basically serves the sound purpose of maintaining a straight, clean hole. In cases of underpowered rigs, an even higher pressure is often created intentionally to momentarily increase the mud volume moving up the hole. This tends to break up any static pocket of cuttings or break up mud rings by adding the horsepower of the falling drill pipe to the pump horsepower. When the pump is stopped for connections, the increased annular fluid weight because of these suspended cuttings creates the flowback customary where drill-pipe floats are not used.

Pressure decrease . . . After the connection is made, the pump is started and circulation again is established (pulling out the kelly and lowering each pipe joint are not shown in the illustration). This same cycle continues and becomes repetitive until the bit is worn out. Normally annulus mud weights will decrease slowly as the bit dulls which enables the pumps to keep the hole cleaner. This effect is omitted for brevity and cleaning is shown to occur during conditioning before the string is brought out of the hole.

When the kelly has been broken off, the effect of the swabbing action as stands are removed can be noted. The

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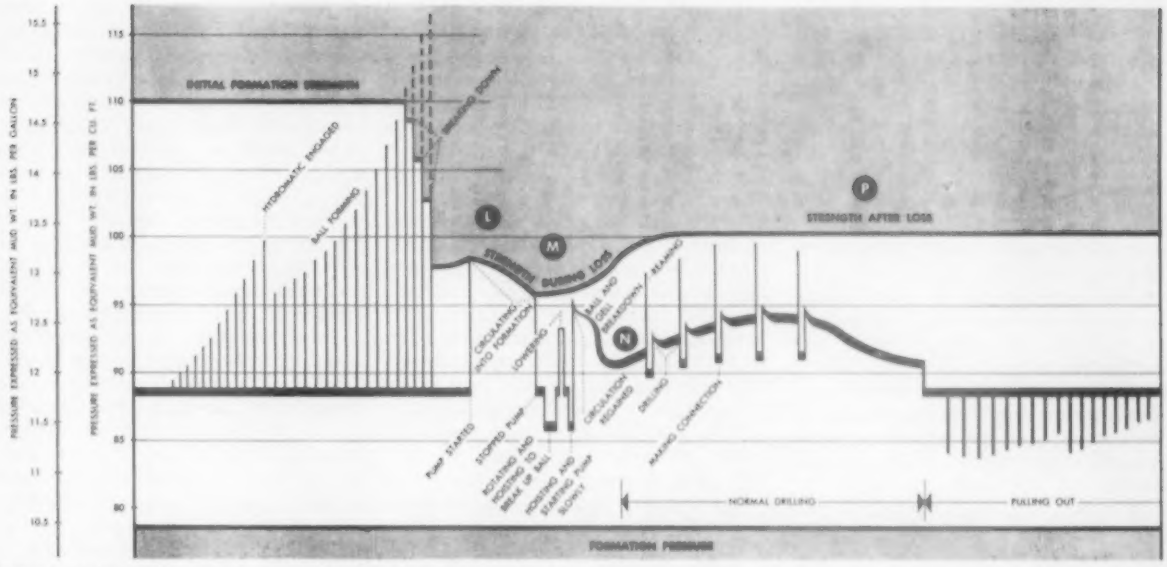


B.H.P. CHART FOR BALLED-BIT lost circulation. This applies in a similar manner to excessive pipe dropping rates, gelled or viscous muds, and unusually heavy filter-cake growths. Fig. 4.

magnitude of these pressure reductions are dependent on the hoisting speed and obviously will vary each time the gears are shifted on the draw works. Thus, reductions are limited initially because the full weight of the drill pipe requires the use of low gear. As stands are pulled, the decreasing horsepower requirements boost hoisting speeds to partially compensate for the decrease in length of the annulus. This compensation continues until limiting engine speeds are reached and pressures begin to fall off with each additional stand. The increased rate of withdrawal upon shifting gears causes the cycle to repeat until the pipe is out of the hole.

At no point in this normal drilling cycle has the pressure come near either danger limit and there is no reason why this should not be just another routine hole. Many wells, however, are not routine and an examination of a similar pressure record from the trouble job often will show why.

Excessive Mud-Weight Buildup

Fig. 3 shows bottom-hole pressure during a drilling cycle for the problem of lost circulation initiated by a buildup of mud weight. This could occur from failure of the shale shaker or insufficient makeup water, or by a buildup of the mud weight in the annulus alone due to insufficient pump capacity for the penetration rate. The rate of increase in the static weight of the mud will be different somewhat for the two cases, but essentially the illustration is the same.

As pipe is started in the hole a normal running-in surge pattern is repeated during the trip to bottom. On breaking circulation and commencing drilling, however, two factors differ from the normal drilling cycle, both stemming from the buildups of the static mud weight as indicated by the dotted lines: (1) The increased weight pushes the entire pressure pattern upward, and (2) the high solids content of the mud generally leads to poorer hydraulic properties.

Eventually the surges and pump pressures even with normal pipe handling can be sufficient to drive the total pressure up to the danger level and there is no safety factor whatsoever for rough pipe handling. Normally, however, these momentary pressure peaks do not instantly break down the formation but act on it in a manner similar to the fatigue failure of metal—slowly at first, and then rapidly as yielding of the wall causes more and more fluid to enter the rupture on the peak portion of the cycle (area G).

Thus, a point is reached (area H) where the formation strength has been reduced by the last reaming operation to a value lower than the pressure required to break circulation. When fluid is pumped in to break circulation, the last formation blocks are washed out and the well fluids will equalize into whatever zone has been opened up. If this equalization pressure is lower than the static mud weight, the hole will not stand full and if it is lower than the formation pressure of another zone, a potential blowout is inevitable.

In either case, the high solids content of the mud, plus the possible sloughing of additional wall cake as the fluid level falls, create all the hazards necessary to stick the drill pipe. Rather than complicate the illustration with a blowout or stuck drill pipe, the chart shows that the fluid level only fell a short distance. Or the dry annulus plus the height of the columns of 97 lb. per cu. ft. (13 lb. per gal.) overweight mud equaled the pressure of the loss. A lost-circulation plug was spotted (area J) while the pipe was pulled back off bottom to a safe waiting point. As the bridging agent plus the wall-building properties of the mud begin to work, the formation strength rises until it reaches some new value equal to the strength of the bridging agent plus the new wall cake.

Regaining circulation . . . Thus, after a reasonable length of time, it is possible to break circulation by swabbing the pipe upward and pumping in very slowly. This method of breaking circulation (with the hole partially empty), allows a reduction in the gel of the mud before the full weight of the entire column of fluid is imposed against the rupture, but has a distinct disadvantage in that it is difficult to determine whether the well is circulating or whether the fluid is going into the formation and washing out all of the effects of the repair.

Proper procedure at this time is of paramount importance, since a wrong move could not only undo everything thus far gained, but also cause even more extensive damage. The filling of the hole with lower-density fluids progresses until surface returns are regained at point K, and the mud is reconditioned.

As shown by the line marked "Formation Strength After Repair," the well bore is now more susceptible to trouble than it had previously been. The

strength of mud cake backed up only by compacted bridging agents or lost-circulation materials is seldom as good as mud cake over natural porosity or unfractured formation.

Pipe Handling

Another problem in lost circulation is triggered by pressures due to running in the hole. Pressure surges of this nature can be caused by excessive pipe-dropping rates, by excessively gelled or viscous muds in the hole, by unusually heavy filter cake growths on the wall of the hole, by oversize drill collars and rubber protectors, or by a balling of the bit on the way in. The illustration shown in Fig. 4 was drawn up for the case of a balled bit, but applies in general to the other problems mentioned.

Pressures are near normal as the string is started in the hole but, with formation of the ball, begin a sharp upswing—eventually reaching the formation strength. As was true in the previous case, such breakdowns are usually slow because of the short duration of the pressure surge and the fact that, initially, not too much fluid is forced into the fissure to wash out mud cake or bridging materials. The increasing surges continue to depress the formation strength, however, until it is too low to support the pressure required to break circulation around the balled bit (area L). Thus, when the pump is started, fluid is circulated into the formation, further tending to wash out the mud cake and decrease the strength.

Mud seals formation . . . For comparison, a different formation reaction is shown than was described in Fig. 3. This action in Fig. 4 is typical: (1) Where losses are occurring into high pressure zones; (2) where losses are occurring through smaller cracks, or openings which can be more readily and more continuously bridged off by normal mud-caking properties; or, (3) where losses are occurring by lifting the geostatic load and storing up fluid. In cases of this nature the hole will stand full during periods of quiescence, and occasionally, after all pressure is released, the settling action of the earth or the compression of gases in the cavity which is accepting the fluid, will return the lost mud to the well bore and eventually back to the mud pits.

With the realization that circulation is lost, pumping is stopped and the rotary table is engaged. With rapid rotation and slow reciprocation, the balling breaks loose to the extent that, after one hoisting and one lowering, the pump was applied and circulation was obtained with the aid of the swabbing action of the pipe (area M). Normal circulation plus rotary action of the bit cleaned up the restriction so that pump pressures returned to normal (area N). With no further fluid movement in or out of the loss zone, the mudding off of the opening (even in the case of a fracture) will return the formation strength to a value reasonable enough to allow normal drilling to progress without further interference (area P).

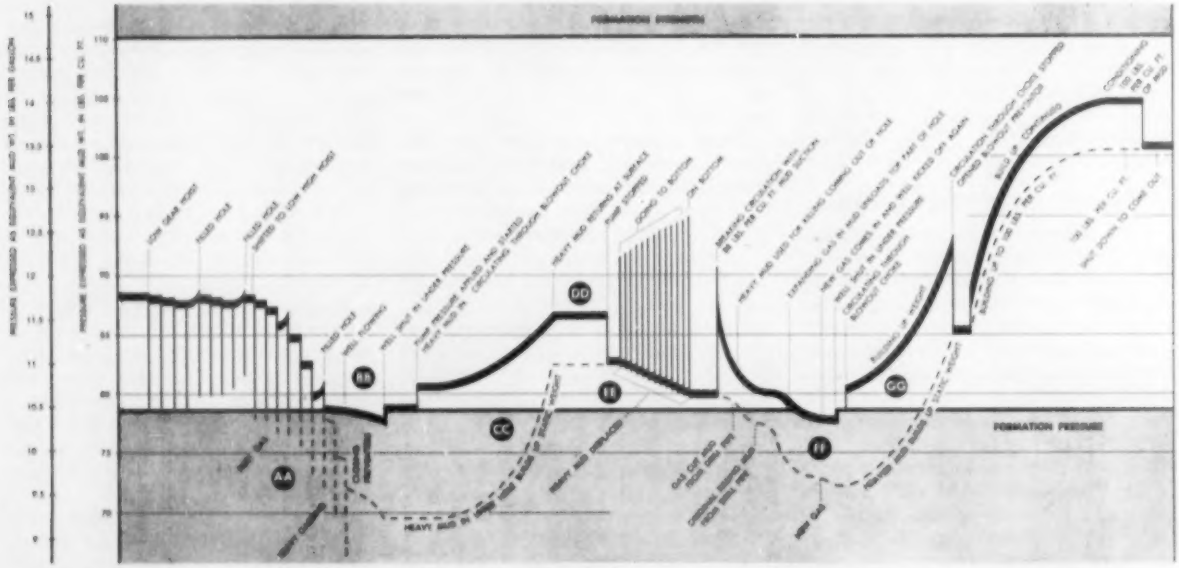
Controlling Blowouts

One additional problem connected with pressure surges that has an indirect bearing on lost circulation should also be discussed. This is the problem of trip gas while pipe is pulled out of the hole. Fig. 5 illustrates how trip gas and a potential blowout might be encountered during withdrawal operations, even though the good drilling practice of always filling the hole is followed. The basic fallacy which is assumed in this case is that the pipe is withdrawn with the mud in poor shape and is withdrawn very rapidly. The same effect can be obtained by coming out of the hole with a balled bit or balled drill collar.

Comparing the first portion of this withdrawal with its counterpart in Fig. 2, it can be seen that the danger described is a combination of two factors: (1) the withdrawal swabbing action, and (2) the decrease in hydrostatic weight due to encroachment of lighter formation fluid or gas. Initially, when the pipe is being removed in low gear, swabbing surges come dangerously close to the formation pressure but do not pull in any gas. Consequently, a normal pattern of constant mud weight and slowly decreasing reductions is noted until gears are shifted.

Well kicks . . . The increased reductions caused by the higher accelerations and hoisting speeds pull in the first gas and initiate the chain reaction which begins as the gas cutting lightens up the mud and decreases the static weight. This means that even though the swabbing surges are falling off, they now continue to be dangerous and even more destructive because of the falling static weight (area AA).

The ratio of the gas drawn in to the total number of stands left in the well will determine whether or not this cycle progresses into the blowout stage or whether it ends up as simply gas-cut



B.H.P. CHART FOR TRIP GAS AND POTENTIAL BLOWOUT caused by pipe handling and poor mud properties. Fig. 5.

mud. In the illustration, the well begins to flow fast enough (area BB) that the blowout preventers must be closed. As the well flows the formation pressure is pulled down, as shown in Area BB.

With the blowout preventers closed, the well will hold a surface pressure equal to the difference between the shut-in formation pressure and the static weight in the well so that circulation must be accomplished through the bypass line and blowout choke. By using extremely heavy mud enough weight can be added in the upper part of the hole (which is the only part that can be circulated) to statically hold the formation in check (area CC). When the pump is stopped (area DD), the well is under control and the blowout preventers can be reopened.

Conditioning dangers . . . The trip to bottom for reconditioning the entire well is started and the often-overlooked problem of different annular densities becomes apparent. For this example the extremely heavy mud at the top of the hole will be the mud which is displaced while running to bottom, causing the static weight to fall (area EE). Thus, when reaching bottom, the static weight of the mud is very close to the danger point.

Circulation under these conditions is invariably hazardous since gas in the mud tends to expand as it is circulated upward. This increase in volume as the gas nears the surface causes violent unloading of the upper portion of the annulus. The decrease in static weight caused by this unloading action is further aided by the fact that the extremely heavy mud initially holding the well in check is circulated out of the hole as soon as circulation is broken.

Consequently, if the over-all static weight of the mud, **plus** the pump pressure required to move the fluid up the annulus, falls far enough, the well will begun to kick again and fresh gas will enter the system. The illustration shows this occurring in Area FF, becoming dangerous enough that the blowout preventers must again be closed and the well circulated under pressure through the blowout choke (area GG). Eventually the weight buildup was adequate to open the preventers and allow routine circulation without further danger.

Possible loss . . . The strong kicking action of the well plus the secondary kicking action on reaching bottom could, in many cases, frighten people into the increase in mud weight shown. Generally such gas shows do actually indicate an adequate relationship between static mud weight and formation pressure, but in this case the inadequacy lies in operational practice. For cases of this sort the problem can, and should, be solved by controlling the swabbing surges and exercising care on the first few days after such gas shows occur.

With the passage of time and the creation of heavier wall cakes, these gas zones will mud off to the point that swabbing surges must be considerably below the actual formation pressure before the gas will permeate into the well bore. On the other hand, unnecessary weighting of the well fluid might cause a permanent damage or impairment to this zone by forming too deep a mud cake over it.

Also, normal drilling from here on will be more hazardous from the standpoint of lost circulation, since the static weight of the mud allows far less safety factor on the positive portion of the pressure pattern. The formation strength will rise with exposure to the heavier mud weight and partially compensate but, percentagewise, the well is far more susceptible to lost circulation than it was before.

It's Easier to Regain Circulation If You Know Where You Lost It

Described here are methods and devices that will help find lost-circulation zones

by C. F. Gallagher

LOSS of mud returns is accompanied usually by serious expenses because of mud costs and nondrilling rig time. These expenses can be reduced if the zone of lost circulation is detected and proper remedial measures are taken at once. Methods used to locate the zone of lost circulation are: spinner surveys, radioactive tracer methods, temperature surveys, lost-circulation detector of California Research Corp., and the fluid velocity indicator of Gulf Research & Development Co.

Spinner surveys have been helpful in a number of cases but are seriously subject to becoming plugged or jammed by the fibrous or flaky materials commonly added to muds to restore circulation.

Experience with radioactive tracers is limited but seems to indicate that the method will need improvement before results can be considered as conclusive.

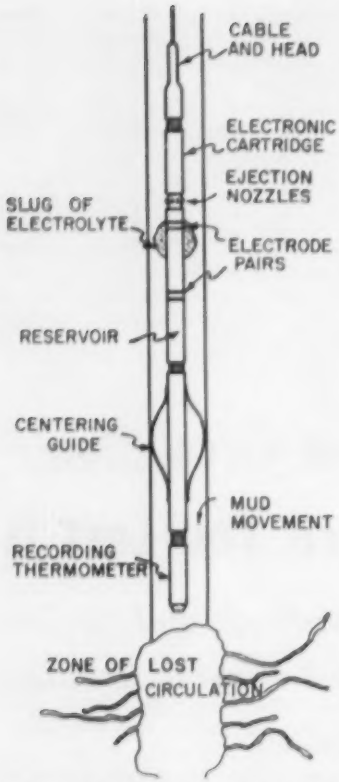
Temperature Survey

Use of the temperature survey to detect the zone of lost circulation has been common for many years. The method is most successful when there is a good temperature gradient and when the rate of loss is substantial. Any standard continuous-recording thermometer can be used.

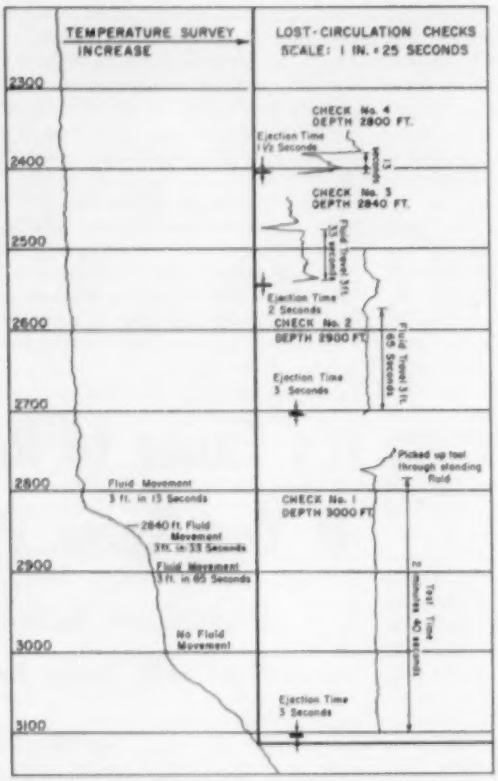
Ordinarily, the temperature gradient in the drill hole is determined after the mud has come to temperature equilibrium with the formation. Additional mud is then pumped into the hole. Pressure is applied, if necessary, to force some of the mud into the formation. The added mud usually is cooler than the formation. A discrepancy between the drill-hole temperature and the formation-temperature gradient will exist down to the zone of lost circulation.

Need difference . . . Where surface-mud temperatures are close to the formation temperatures, as at shallow depths, it often is possible to change the mud temperature several degrees by either adding ice or dry ice to the mud or by heating the surface mud with steam.

The use of the temperature survey enjoys certain advantages: (1) the instrument and method are not directly affected by the fibrous, flaky mud additives generally introduced before the survey; (2) the technique is well known and generally practiced; (3) the service is widely available; (4) fluid flow is not required during the survey, although moderate flow can be tolerated; and (5) the survey is continuous and fairly fast. But the method has definite limitations: (1) substantial rates of loss are required before the survey; (2) the extent of the zone is not apparent; only the top of the zone is clearly indicated;



LOST-CIRCULATION DETECTOR, shown in the hole just above the zone of lost circulation. Fig. 1.



FIELD EXAMPLE of use of lost-circulation detector. This survey was made in Kern County, California. The zone can be located within a foot or two. Fig. 2.

LOST-CIRCULATION DETECTOR, assembled for use. Fig. 3.

and (3) multiple zones are seldom indicated.

Lost-Circulation Detector

California Research Corp. invented and holds patents on a device specifically designed to pin point the zone of lost circulation. This method involves ejecting into the mud column a fluid of low resistivity and then detecting the flow of the fluid past suitably placed electrodes. Above the zone of lost circulation, fluid movement will be indicated. Below the zone, no movement will be indicated. The temperature survey is run in conjunction with the device and is used to indicate zones requiring closer study.

A diagrammatic sketch of the equipment above the zone of lost circulation is shown in Fig. 1. The equipment is operated from a standard logging truck. As described by Williams and Coombs,[1] the essentials of the equipment are: (1) the ejection system consisting of a reservoir to contain the electrolyte and the ejection nozzles with a solenoid operating valve; (2) the detection system consisting of a pair of electrodes placed 6 in. below the nozzles, another pair of electrodes placed 3 ft. below the first pair and electronic cartridge to provide resistivity measurements; (3) the thermometer; and (4) suitable centering guides. Surface equipment consists of the necessary mechanisms to operate the ejection valves and a time-driven photographic meter to record the electrical signals from the electrodes. Electric power to the device is provided also from the surface-control panels.

The device is approximately 17 ft. long and has a 4½-in. maximum outside diameter except for the spring-guide centering device which is capable of expanding to approximately 15 in. in diameter.

. . . The fluid ejected must have a low resistivity to contrast with the drilling mud. It is not possible to use a high-resistivity fluid in the presence of saline muds. The fluid must have fairly constant resistivity over fairly wide ranges of dilution. It must be quite soluble and stable in solution over a wide range of temperatures. It must not flocculate or coagulate the drilling mud since this would interfere with ejection. A solution of lithium citrate has been found to have these properties and is the fluid used.

Finding zone . . . The lost-circulation device is run in conjunction with a temperature survey. The temperature survey is ordinarily run going down the drill hole to avoid disturbing the mud column and to save time. Anomalies in temperatures are recorded at the surface to indicate the zone of lost circulation. The zone to be examined in detail is selected from the temperature survey.

The device is then raised above the zone. Mud is caused to flow even if pumps and lubricators for the cable are required. The optimum rate of flow is about 50 bbl. per hour in normal size holes. The flow need be forced only during the 2 or 3 minutes required for an observation.

Getting detail . . . With mud flowing, fluid is ejected into the column. The

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fluid moves downward with the mud, passing the first set of electrodes causing an unbalance of an electronic bridge. This sends a signal to the surface. The ejection and the signal are recorded automatically vs. time. As the mud moves, the slug of fluid passes the second set of electrodes, again unbalancing the bridge, and this signal is recorded on the same time log. Rates of flow can be estimated from the time required for the slug to pass between the two sets of electrodes. The times involved in actual practice, range from a few seconds to several minutes.

The device is then lowered to a point estimated to be below the zone of lost circulation and the operation is repeated. If there is no flow, the second signal will not appear since the slug will remain stationary. This is checked by raising the device so that the electrodes pass through the slug. Several observations bracketing the zone can locate the zone within a foot or so. Fig. 2 is an actual field example. Fig. 3 is a photograph of the assembled equipment.

This method is capable of locating the point of lost circulation quite accurately. With some knowledge of hole diameter, a fair estimate of the rate of loss into particular horizons can be made. Inherent disadvantages are: (1) flow is required; (2) drilling muds must be conductive but must not be saline; (3) the method does not lend itself to operation within casing, and (4) flaky, fibrous material can plug the ejection nozzles since the fluid must be ejected at low pressure.

Fluid Velocity Indicator

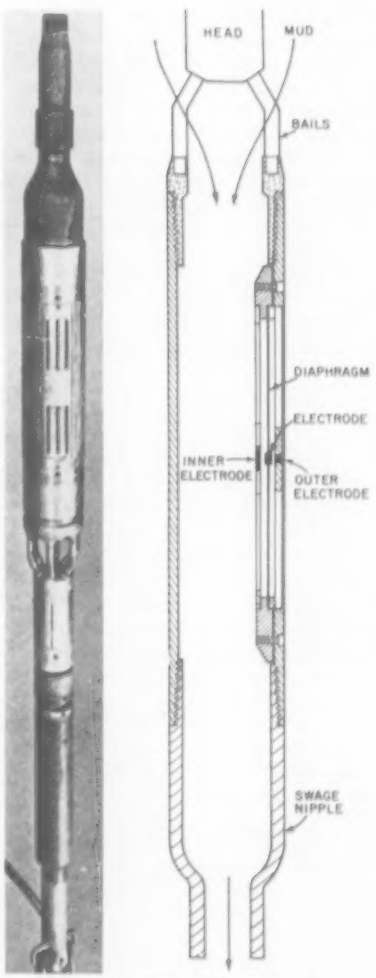
Gulf Research & Development Corp. recently has developed and described a fluid-velocity indicator[2] to use in locating zones of lost circulation. This method involves using a short tube and swage to restrict a part of the flow of mud in the drill hole. The resulting pressure differential operates a system of electrodes. Flow of mud is indicated by a displacement of the electrodes causing an electrical signal to be recorded at the surface.

Fig. 4 shows a cross-section of device. It is 52 in. long and has a 5-in. maximum outside diameter. The main body of the device is a tube with a 5-in. o.d. and a 4-in. i.d. The top of the tube is open. The tube is suspended from a logging cable by six heavy steel bails. The bottom of the tube is fitted with a swage nipple to constrict the mud-flow path through the tube. The constriction from 4 to 1½ in. diameter creates a pressure drop when drilling mud flows through the tube so that the pressure inside the tube is slightly greater than the pressure outside.

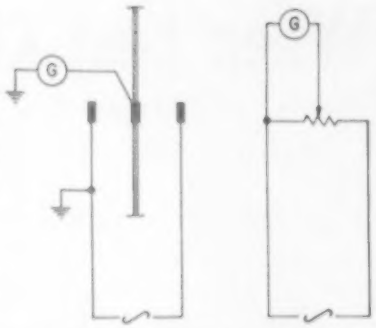
Flow detection . . . There is a window covered with a neoprene diaphragm on one side of the tube. This diaphragm with some associated electrodes is the sensing element. Mounted on the diaphragm is an electrode that moves with the diaphragm. Fixed with respect to the tube are an inner and an outer electrode. Fig. 5 is a schematic circuit diagram showing the electrode.

An alternating current is impressed across the inner and outer electrodes and flows through the mud and the diaphragm electrode. This is essentially a potentiometric circuit in which the potential at the diaphragm electrode depends upon the position of the electrode which, in turn, depends upon pressure differential across the diaphragm. Thus the potential indicates the rate of flow of the mud column.

The instrument is run from a standard electric logging truck. Surface controls required are those normally used in logging. In operation, the device is lowered to some convenient depth below the mud level—preferably within casing.



FLUID-VELOCITY INDICATOR is used by Gulf to locate lost-circulation zones. Photograph is at left and cross-section is at right. Fig. 4.



ELECTRICAL CIRCUIT for Gulf's fluid-velocity indicator. Fig. 5.

Bracketing zone . . . The location of the lost-circulation zone is accomplished by either of two methods or a combination of them. One is the bracketing method. The device is lowered halfway to bottom. If flow is indicated here, the loss zone is in the lower half; if there is no flow, the loss zone is in the upper half. The instrument is then moved to the middle of the half that has the loss zone and another reading is taken. This procedure is repeated until the exact zone is determined.

The other method involves lowering the device in successive intervals of convenient length, say 1,000 ft., until no flow is indicated. The device then is raised in shorter intervals, say 200 ft., until flow is indicated. Successively shorter intervals are used until the exact zone is located.

Several field examples are described in detail in the literature.[2]

Experience with this new device is rather limited but it seems to enjoy certain advantages: (1) simplicity of construction and operation; (2) can be used in casing; (3) workable over a wide range of mud resistivities; and (4) not particularly subject to clogging by fibrous, flaky material. Its disadvantages are: (1) limited supply of equipment at this time; and (2) mud flow at a substantial rate is required.

Acknowledgments

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When Lost Circulation Besets You . . .

You have three alternatives—

1. Drilling without returns
2. Using preventive methods
3. Attempting to regain circulation after its loss

by C. C. Liedholm

HANDLING lost returns is not merely a matter of trying various methods to regain circulation after it is lost. The operator has three basic means at his disposal for combating the problem: (1) drilling without returns; (2) preventive methods; (3) attempting to regain circulation after its loss. Each basic method has advantages and disadvantages. The choice of method depends upon conditions in the area and in the individual well.

The selection of a method, or methods, for handling lost-circulation problems is primarily one of economics. The least-expensive method, compatible with safety, is the one every operator or drilling contractor wants to use. However, a method which will overcome lost circulation at low cost, but which materially reduces the productivity of the well, is certainly not economical. Also, a method which precludes accurate evaluation of possible pay zones or which deprives the operator of important geological data may be uneconomical.

Drilling Without Returns

It is not practical always to attempt to regain circulation. In some areas drilling fluid leaves at many depths over a long interval. Circulation may be regained at one depth, only to be lost again in the next few feet drilled. If the condition is too severe to be controlled by material which can be carried in the mud, drilling without returns may be the most practical answer.

In the Neutral Zone between Kuwait and Saudi Arabia, a cavernous-lime interval between 1,000 and 3,000 ft. is drilled in this manner. Water is pumped away at rates up to 500 bbl. per hour. Installation of 25 miles of pipeline from the Persian Gulf to provide sufficient water was made for this operation.

Drilling without returns also is fairly common practice in depleted oil zones. Use of lost-circulation material or cement in a zone to be produced can be extremely harmful to well productivity. Several California fields are being developed by drilling with oil throughout the producing interval. In Inglewood field, oil is used for drilling through depleted zones in wells which are to be completed in a deeper pool. This practice was adopted to prevent damage to producing wells nearby. In some fields, such as Ellwood, water can be used in the producing zone without appreciable zone damage.

To drill without returns, certain basic conditions are necessary. High-pressure zones, or formations with tendency to cave, must be cased prior to loss of returns. If drilling without returns is to be conducted in a producing zone, adequate quantities of a fluid not harmful to productivity must be available.

The principal disadvantages of drilling without returns are:

1. Difficulty in electrical log interpretation following loss of oil or water to producing zone.
2. Loss of geological data ordinarily derived from cuttings.
3. Hazards from possible blowout under certain conditions.
4. Possible sticking of drill pipe due to caving.
5. Possible damage to producing zone from particle infiltration.
6. Deferment of initial production while producing lost oil or water.

Drilling without returns can be considered a last resort. In many cases, however, the expense or the impairment of productivity which results from attempts to regain circulation, completely justifies the practice of drilling without returns.

Preventive Methods

Control of the drilling fluid to prevent lost circulation has become more prevalent in the last few years. In many areas, circulation is lost in minute crevices which are widened by the hydrostatic pressure of the mud column.[1] If these crevices can be bridged immediately, or can be otherwise prevented from widening, loss of circulation can be avoided.

Control of mud density at a safety level and practices which minimize shock loading can always be applied. Also, the use of bridging material carried continuously in the mud is becoming common practice, particularly in the Gulf Coast area.[1,2] Walnut shells, ground fine enough to pass through the shakers, have been found to be effective in notorious lost-circulation areas. This finely ground material does not interfere with the drilling operations in any respect. Laboratory tests indicate that material graded from 30 to 100 mesh will effectively bridge crevices up to 0.03 in. wide with 1,000 psi. differential pressure.[2]

In extreme cases, lost-circulation problems are handled by drilling with air or gas.[3] Cable-tool drilling also has been employed. Aeration of the drilling fluid to lighten the mud column also is being field tested.[4]

Regaining Lost Circulation

Once returns are lost and conditions are not conducive to drilling ahead without returns, the operator must adopt one of several means for regaining circulation. His choice of method is influenced by (1) the severity of the loss; (2) the depth and condition of the hole; (3) the material readily available, and (4) the type of formation into which he believes the circulation is going. His decision also will be based upon experience of other operators in the area and upon his own experience with lost circulation.

In some cases simple reduction of the density of the circulation fluid will be effective. Sealing materials, both granular and fibrous, are used commonly and are, in many cases, successful. The use of cement, plastic, and plaster of paris, is common. The above methods are well known and, with a few exceptions, are applied with no particularly unusual techniques. Applica-

tion of diesel oil-bentonite-cement is covered in the literature.[2]

... **Use of coarse gravel** for bridging a highly fractured zone was introduced during development of the westerly extension of the Ellwood field, Santa Barbara County, California. Gravel of 6 to 9-mesh size was pumped into the well using conventional gravel-packing surface equipment. The gravel was followed with neat or gel cement. In some cases plaster sand was used in conjunction with the gravel. This method was only moderately effective at Ellwood but no method for regaining circulation would work consistently. All types of lost-circulation material disappeared without a trace. Cement, if displaced accurately to the point of loss, was sometimes effective, but most cement jobs would break down during later drilling.

Planning

In many oil fields lost circulation is one of the major development problems. During a long drilling program in one area the operator can, by trial and error, establish a successful measure for control. If drilling a new area, information from other operators on lost-circulation conditions usually can be procured. When this is not possible, geologists can sometimes provide information regarding the depths of formations which may take fluid.

There is a multitude of variables which influence an operator's choice of lost-circulation-control methods. An evaluation of methods with regard to all of these variables is not within the scope of this article. Many of the variables become manifested in one factor, whatever the severity of fluid loss. Planning for lost circulation can be discussed with respect to four degrees of severity:

1. Partial returns with drilling fluid of normal density for depth and area. In almost any area it is possible, under certain conditions, to lose returns momentarily, or for the hole to take some mud. This condition may correct itself as the lost-circulation zone becomes mudded off with cuttings. Reduction of mud weight where possible, or the temporary use of common lost-circulation additives, usually will correct this condition.

2. Partial or complete returns possible with reduced fluid density. In the Gulf Coast area it is common to lose returns at a given mud density. By reducing the density only ½ lb. per cu. ft., it is often possible to reestablish complete returns. Under these conditions loss of returns can be avoided by careful control of the mud characteristics. If high-pressure zones are open, a delicate balance between loss of returns and loss of control may have to be maintained. In wells where this balance becomes too critical for safety the use of finely ground bridging material has been effective.

In planning a drilling program for such an area, a rigid mud program must be established and followed. The casing program for the well must be tailored to progressively protect weak zones from high-density mud required to control abnormal pressures of deeper horizons.

3. No returns, but fluid level remains near surface. Where circulation cannot be maintained regardless of the density of the liquid in the hole, more drastic measures may be required. If circulation is being lost into formations above the producing zone, the use of fibrous or granular lost-circulation materials may be effective. This condition is common in many of the eastside San Joaquin Valley fields and in several California coastal fields. Many operators have found that cementing off the zone which is taking fluid is more practical than continued use of lost-circulation material.

Most operators are hesitant to use cement or lost-circulation material in the producing zone. It is generally accepted practice to drill with oil through depleted zones in which returns cannot be maintained during drilling. The offshore main zone at Huntington Beach has been developed in this manner to a large extent. One of the principal disadvantages of this procedure results from the loss of data for evaluating the pay zone. Fairly satisfactory electrical logs can be obtained by spotting mud on the bottom prior to logging. The use of such an electrical log in conjunction with production data from adjoining wells usually is sufficient for evaluation.

In planning a development program in which the producing horizon is to be drilled with oil, several factors must be taken into consideration. A casing program which protects the hole is necessary. An adequate supply of clean, degassed oil must be available. Extra precautions and cleanliness around the rig are mandatory. Also a program in which key wells can be evaluated accurately is advisable. Circulation should be regained and maintained in sufficient wells to provide core or electrical log information as required for well completion and reservoir analysis.

4. No returns with fluid level at or near point of lost circulation. In a few areas lost circulation is so severe it is not possible to maintain more than a few feet of fluid in the hole above the point of lost returns. This condition may occur in formations above the water table—such as South Mountain. Unless a nearly unlimited supply of water is available, an operator must plan to drill with cable tools or resort to air drilling until such formations can be cased off.

Low-fluid-level loss also can occur in depleted producing zones which are cavernous or badly fractured. In Ellwood field the top few feet of Vaqueros zone is a dense sandstone which apparently broke into wide fissures during folding. Much of the field was developed after the formation pressure in the Vaqueros was less than 350 psi. The most economical program consisted of drilling the zone without returns using salt water as a circulating medium. In a few key wells circulation was regained, and continuous core data were obtained in addition to reliable electrical logs. In some areas in the field, the cost of regaining circulation prohibited regaining returns even in key wells.

"Most operators are hesitant to use cement or lost-circulation material in the producing zone. It is generally accepted practice to drill with oil through depleted zones in which returns cannot be maintained during drilling."

THE AUTHOR

C. C. Liedholm is chief petroleum engineer, Signal Oil & Gas Co. He joined Signal in 1941 after receiving a B.S. degree from University of California. He has been chief petroleum engineer since 1951. This article was presented at the 1956 spring meeting of the Pacific Coast District of the A.P.I. Division of Production, Los Angeles, under the original title, "Methods of Handling Lost Circulation."

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?

When trouble comes . . .

This is the first of a series of six articles on maintenance of catalytic cracking units. Others will appear at intervals of approximately 3 weeks. Subjects for this series will be:

1. Emergency Repairs on Operating Equipment.
2. Cleaning and Protection of Heat-Exchange Equipment.
3. Installation and Servicing of Monolithic Liner and Wear Plates.
4. Design and Maintenance of Flexible Pipe Joints.
5. Maintenance and Adjustment of Slide Valves.
6. Planning and Execution of Turnarounds.

The author first wrote on cat-cracking maintenance for the Journal in March 23, 1953, issue. His subject: Erosion Problems and How to Solve Them.

At the conclusion of this series, these six articles, plus the original article, will be reprinted.

Shut It Down, or Make Hot Repairs?

Welding can be done safely on catalytic cracking units during operation, provided proper precautions are taken. Here are detailed lists of safe procedures for preparation steps and actual welding operations.

by J. S. Clarke

IN the operation of catalytic cracking plants, minor failures or difficulties occasionally arise which require welding to make repairs. A decision must be made, then, either to bring the unit down or to make the necessary repairs while the unit is in operation.

The engineering safety aspects of welding on operating equipment are such as to require extreme caution and a degree of planning which anticipates every possible contingency. This article outlines practices and precautions to be considered, should the decision be made to make hot repairs. The procedures outlined have been evolved over many plant years of maintenance experience and were developed mainly for the cracking and main fractionator sections of fluid catalytic cracking units.

The decision to make hot repairs should be a joint matter unanimously agreed upon by representatives of all components of the refinery organization who have an active interest in operation and maintenance and who are qualified to appraise every aspect of the particular job to be done. Personnel normally involved would include those from engineering, process, safety, equipment inspection, and mechanical supervisory personnel who will be in charge of the field work.

Safety Procedures

In a typical case, a welding permit is issued for hot work at the point of repair by the proper management representative, after suitable investigation of area conditions and the necessary preparations have been made. This includes tests to determine the presence of flammable gases and hydrogen sulfide. When working on regenerator flue gas lines or in the vicinity of the effluent, a check is made for the presence of CO.

These tests are made with an approved type portable gas indicator operated by qualified and authorized personnel. Wind direction should be considered in relation to possible sources of hydrocarbon gases. The permission to do hot work may be made contingent, if necessary, on specified wind conditions. Subsequent tests may be specified at regular intervals during the work together with repeated checks of wind conditions. A continuous check of both or either may be felt to be necessary, depending upon circumstances.

Precautions . . . The following precautions should be observed in preparing to carry out repairs involving hot work:

1. Employes engaged in the work should be familiar with the specialized procedures and equipment used as well as the proper safety considerations. Preferably they should be experienced, but failing this, they should have adequate instruction.

2. Consideration should be given to the need for more than one escape exit from the immediate hot work area, and participating personnel acquainted with exit routes.

3. A fire extinguisher of a type and size designated as suitable by the hot-work inspector or other qualified person must be included in the equipment of every employe preparing to do hot work. These should be carried to the point where work is to be done and kept within easy reach.

All fire extinguishers should be inspected to determine that they are fully charged and in good working order and shall not be tampered with under any conditions.

4. All employes engaged in hot work must be familiar with the proper handling of the several types of fire extinguishers available at the location.

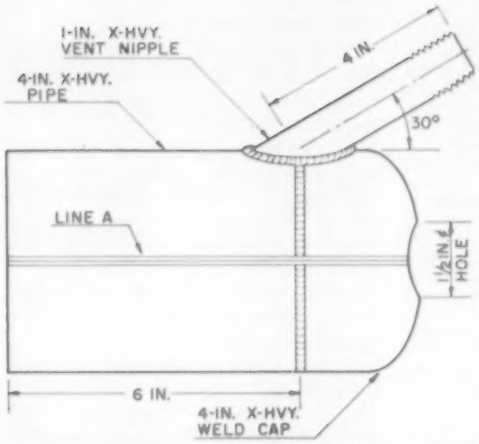
5. At some refineries a water hose equipped with a fog nozzle and connected to the high-pressure fire system and also a steam hose connected to the steam supply line are made available in the hot-work area.

6. A thorough inspection must be made of all catch basins or sewer manholes for trapped hydrocarbon and if necessary they shall be flushed out with water. The tops of such basins or manholes must be covered to prevent the possible escape of gases and entrance of sparks.

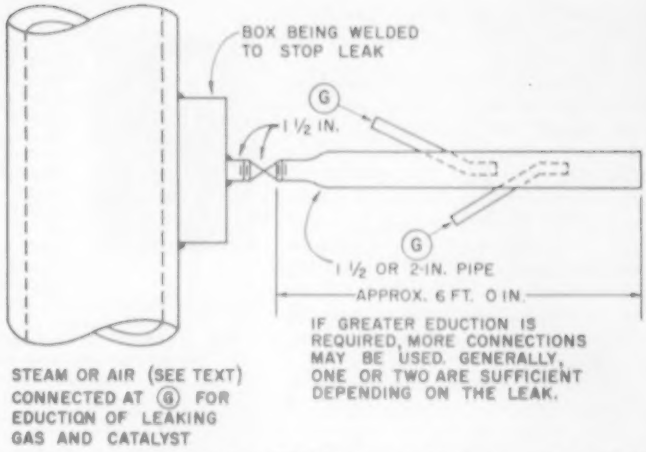
7. Unauthorized persons should be prevented from entering the hot-work repair area.

Preparation for Welding

The first step in preparing for hot repairs is to decide whether or not it is necessary to cut out oil feed or any other source of hydrocarbon which would cause leakage at the point of repairs to be flammable. Next, condi-



VENTED WELDING BOX used for boxing 1-in. aeration connections which are needed in making hot repairs. Fig. 1.



BAZOOKA FOR MAKING REPAIRS where leaking gases contain catalyst. This discharges the gas and catalyst at a point away from working area. Fig. 2.

tions should be analyzed and equipment examined to make sure that no air or oxygen has entered or can enter the equipment.

Before welding, it should be determined, either from actual measurements or from inspection records, if reliable, that there is sufficient metal thickness to permit welding without burning through. Throughout the work, a competent process operator should be present to advise of any change in operating conditions which would have an effect on the work.

The following additional measures of a general nature should be considered and carried out where applicable. Other preparatory steps of a similar nature may be suggested by the particular circumstances of the job to be done:

1. Install temporary insulation, if necessary, around area to be welded to protect the workers from radiant heat.

2. If a leak is to be repaired, portable fans should be set up to blow the hot leakage away from the workers. The pressure at the point of leakage should be reduced to the minimum possible value.

3. All rust and scale should be removed from areas to which weld metal will be applied.

4. Protection against rain or high wind may be afforded by erecting a temporary shelter if necessary.

5. If a small leak is to be repaired, it is sometimes possible to temporarily stop the leaking catalyst by caulking the adjacent metal and making it flow into the crack. Alternatively, it may be possible to stop a leak temporarily by caulking the crack with steel wool, copper wire, or asbestos rope.

Welding Procedures

Where leakage is involved, the general practice is to put a patch over the leaking area. The patch is vented by a valved nipple during welding and the valve closed after the patch is welded in place. On the side of a vessel or line, the patch may be flat or contoured if necessary to conform better to the shape of the vessel or line.

Where the leak is at the junction of lines or at a nipple connection to a vessel or line, a so-called "box" is made, usually in halves, which fits around the leaking junction and is welded in place. Like the patch, the box is vented and the vent valve closed after the box is welded into position.

Fig. 1 is a drawing of a typical vented split welding box used for boxing the 1-in. aeration connections. Many refineries keep a supply of these boxes on hand in various sizes so that they will be available for immediate use if required. Procedure of fabricating these boxes is as follows: (1) Weld 4-in. extra-strong pipe to 4-in. extra-strong welding cap. (2) Burn oval hole in center of welding box. (3) Insert and weld in 1-in. extra-heavy vent nipple to assembly as shown in Fig. 1. (4) Split assembly into two halves on line A and bevel the edges. (5) Burn hole in cap to coincide with outside diameter of 1-in. aeration nipple.

The size of the patch or box to be used in any particular case will be determined by the size of the leaking crack or hole and the soundness of material around the defect.

Various suggestions and procedures in connection with installing an overlay patch where leakage is concerned are:

1. The patch should extend well beyond the leak in all directions.

2. The thickness of the patch should be approximately the thickness of the shell to which fastened in most cases.

3. The vent should be directly over the leak so that leakage will be carried away and not interfere with the welding.

4. Vent nipples should always be equipped with opened valves before the patch is installed since leaking catalyst may subsequently make it difficult to place the valve on the nipple.

5. Even though a leak has been stopped temporarily by caulking, the overlay patch should be equipped with vents in case subsequent welding of the patch causes the leak to commence again.

6. When repairs are required to "box in" leaks in which oil vapors are present in the leakage, precautions must be taken to insure that welding is done only when the leak is blanketed by steam through a separate connection on the box.

When repairing a crack, gussets, sometimes called "strong backs," may be installed somewhat beyond the ends of the crack perpendicular to it. This helps to prevent propagation of the crack when the metal is heated in welding. If a patch is then installed, it would be cut to fit in between the strong backs.

Excessive catalyst discharge . . . If the discharge of catalyst from the leak is excessive and hampers mechanical work a "bazooka" may be attached to the patch vent to discharge the gas and catalyst at a point away from the working area.

A bazooka consists of a piece of 1½-in. or 2-in. pipe approximately 6 ft. long with ½-in. nipples welded into it at an angle as shown by Fig. 2. Steam or air may be connected to the ½-in. nipples for educting the leakage. Steam is used on the spent-catalyst side, and air is used on the regenerated-catalyst side. If greater eduction is required, more connections may be used. Generally, one or two are sufficient. Once

the welding is completed the valve against the patch is closed and the bazooka removed.

In certain cases whole flanges have been boxed in. Here the box must extend beyond and enclose the flange bolts and attach to the line. Where difficulties have been encountered repeatedly with leakage of large flanges the problem has been solved by welding a ⅛-in.-thick band ½ in. wide between the flanges on the inside of the line. Internal access is necessary to do this, of course. The band is removed from within when the flanged connection is opened.

In removing the box around a nipple or flange, provision must be made for the free escape of air or gas within the box before any heat is applied such as by a cutting torch. **This applies whether the unit is operating or not.**

Construction requirements . . . The following requirements and procedures have been established by one particular refinery for patches and seal boxes which are to be welded over leaking areas.

For boxes fabricated from pipe or pipe fittings:

1. Steam inlet and drain connections equipped with valves shall be provided on the welding box.

2. The box should be installed in such a position that the drain connection will be located at the lowest point.

3. The head or closed end portion of the box will be fabricated in the following order of preference: (1) welding cap or threaded bar stock plug; (2) saddle-type head, (3) flat head. If a flat head is used, the thickness of the head plate will be determined by the equipment inspection or mechanical-engineer department.

Fabricated steel plate boxes. In certain cases the contour of the equipment is such as to prevent the use of overlay patches and a box fabricated from steel plate is required. The design of boxes having large flat areas subjected to internal pressure is much more complicated than patches. In such cases qualified mechanical-engineering design personnel should be requested to develop a suitable design. As with pipe boxes these also should have steam inlet and drain connections equipped with suitable valves.

A record should be maintained of all repairs made while equipment is in operation in order that such repairs may be dismantled during the following turnaround and permanent repairs effected. It is especially important that all boxes installed during the run be removed when the plant is down since they may very likely contain trapped liquids which can expand and rupture the box as operating temperatures are applied during the following unit startup.

THE AUTHOR

J. S. Clarke has been with Esso Research & Engineering Co. since 1937, with most of his work over the years having been concerned with mechanical engineering design and development in connection with the fluidized solids process. At present he is assistant supervising engineer of the mechanical engineering section in the design division at Linden, N. J. He earned a B.S. in mechanical engineering from Rutgers University in 1932 and got his master's in that field while serving as a full-time Rutgers instructor in mechanical engineering from 1933 to 1937. His company career was interrupted from 1942 to 1946 when he served with the Army's Quartermasters Corps (during 1944 and 1945 he served in uniform with the Petroleum Administration for War). He holds four U. S. patents. Born in Pittsburgh, he now lives in Cranford, N. J.

Making Hot Taps

Occasionally it becomes necessary to tie a new line into operating equipment without removing the equipment from service. The procedure is termed "hot tapping." All safety precautions outlined previously for doing hot work must be satisfied before proceeding. An additional requirement here is that flow should be maintained in the line to carry away the heat of welding.

Here's how one refinery does it:

1. Check all available inspection records to make sure there is sufficient metal thickness to permit safe welding on the drum, vessel, or pipeline. (As a further precaution against burning through, the welder may test the amperage of the welding machine on a sample piece of metal the same thickness as the equipment to be welded.)

2. When any doubt exists as to metal thickness, suitable means should be employed to spot check actual thickness.

3. Check the type of metal and the series of fittings to be used on the connection.

4. After the nozzle has been welded on, the proper gate valve for that particular job is bolted to the nozzle flange (with proper gaskets).

5. A pressure test of one and one-half times the flange rating is applied to the assembly to test the welded connection at the vessel.

6. The hot tapping cutter is a standard commercially available tool. In essence, it is a boring bar mounted on a shaft which turns in a packing gland bolted to the outside valve flange and is driven by an air motor. The diameter of hole to be cut must be slightly smaller than the opening in the fully opened gate valve.

7. The shaft is advanced by hand until the cutter point touches the pipeline or vessel wall. The cutter is completely withdrawn and the valve closed as a safety check on clearances.

After the clearance check, the valve is reopened and the cutter is again advanced until it touches the pipe or vessel.

8. The feed indicator scale is set at zero and the machine set for automatic feed.

9. The air motor is attached and the drilling operation started. The depth needed to advance the drill to complete the cut depends on the size of pipe and nozzle. A table is supplied by the manufacturer showing the amount of travel necessary to complete the cut, starting with the point of the pilot drill in contact with the pipe.

10. The drilling is continued until the feed indicator shows that the required depth has been reached. This may be checked by turning off the air and advancing the cutter manually. If the cutter moves freely, the cut is then complete.

11. The cutter is now withdrawn beyond the valve gate and the valve closed. When working at any significant pressure, a bleed-down connection should be provided in the tapping assembly between the gate valve and the cutter shaft stuffing box. The pressure in this chamber may thereby be relieved before removing the drilling machine.

This valve must be checked carefully to insure that it is closed during the cutting operation.

12. The hot tapping device is finally unflanged from the gate valve and the new line installed against the valve.

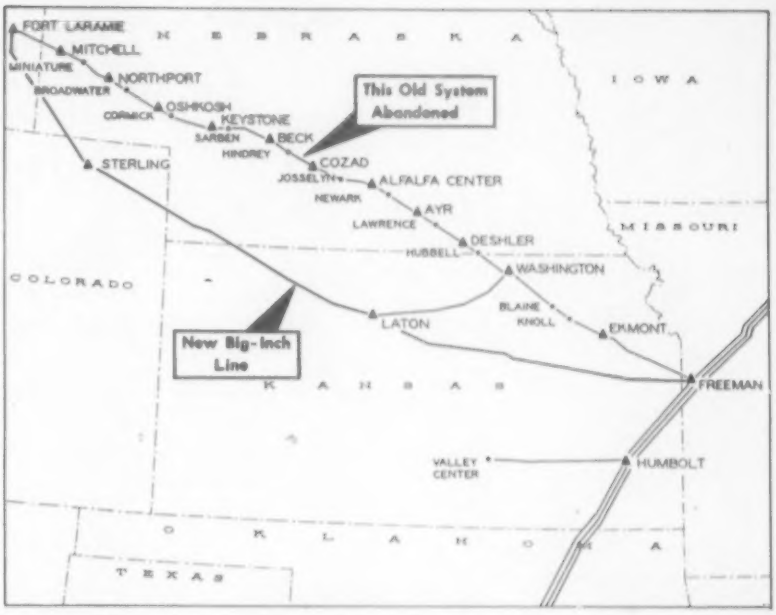
"Before welding, it should be determined, either from actual measurements or from inspection records, that there is sufficient metal thickness to permit welding without burning through."

WATER—might freeze and damage pipe

NATURAL GAS—available and cheap . . .

So—

Natural Gas Is Used to Displace Old Crude Line . . *with the problems and solutions here told*



ROUTES OF OLD AND NEW crude oil pipelines. Most of old system was displaced with gas, which was then bled to atmosphere. Fig. 1.

by A. M. Hill

IN 1954 Service Pipe Line Co. built a 20, 22, and 24-in. pipeline from Fort Laramie, Wyo., to Freeman, Mo. Then, 775 miles of 8, 10, 12, and 16-in. pipe in three lines were abandoned. These lines had previously served areas which the new line crossed.

An unusual feature of the abandonment program was the use of natural gas instead of water for displacement of much of the pipe. This report gives procedures followed in evacuating crude oil from the lines, which were as follows, (see Fig. 1):

1. Wyoming line—Mitchell, Neb., to Freeman, Mo., 553 miles of pipe. One line was composed of loops of 12-in., and 16-in. pipe, and a parallel line from Washington, Kans., to Freeman was composed of loops of 8, 10, and 12-in. pipe.

2. West Kansas line—from Laton, Kans., to Washington station; 116 miles of 10-in. pipe.

3. East Kansas line — from Valley Center, Kans., to Humboldt station, 108 miles of 8 and 10-in. pipeline loops.

Why Gas Was Picked

Our schedule for dismantling the station piping systems and intermediate junctions on the Mitchell-Washington line caused us to displace the line in bad weather. So, it was decided to use natural gas or compressed air as a displacement medium instead of water, since water could freeze in the line and in the pumping equipment.

In evaluating the cost of gas vs. rental and operating costs of two 600-cu.-ft. diesel-engine-driven compressors, gas was found to be cheaper, and it proved to be more satisfactory than compressed air for this job.

The gradient of the line, which has a slope of 6.68 ft. per mile across Nebraska and Central Kansas, permitted displacement with gas at a relatively low pressure.

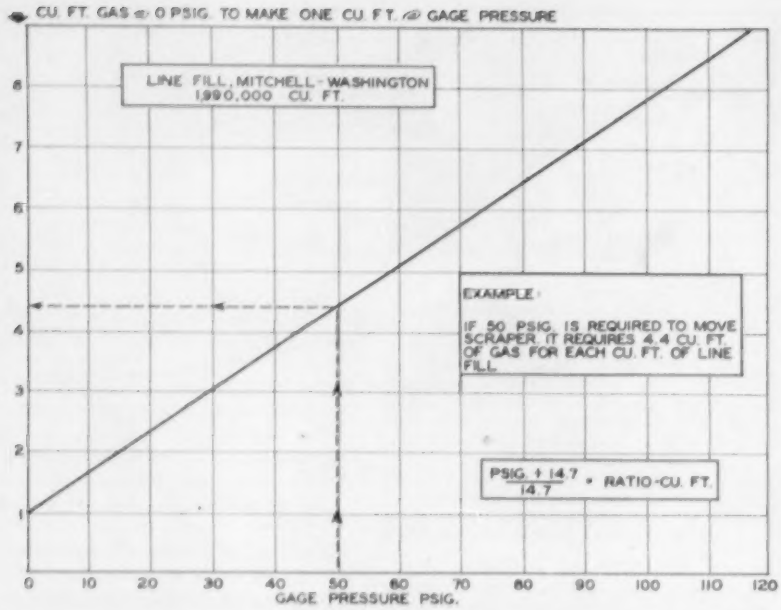
The use of natural gas presented an opportunity for accidents and explosions, and extra safety precautions were observed. These precautions also apply when compressed air is used as a displacement medium for displacing lines in Service's system. The labor cost of displacing the line could have been materially reduced if sufficient oil had been available to run scrapers through the lines to remove the heavy sediment, scale, and sand before final displacement was begun.

After the method most suitable for displacing these lines was decided a detailed plan was prepared by the general manager to coordinate the work to be carried out between the general office and field personnel, also to point out the safety precautions that would be observed.

Fig. 2 is a graph, also a formula for computing cubic feet of gas required to displace a cubic foot of oil from a pipeline from 0 to 100 psi.

1. Natural gas was used to propel the special displacement scrapers through the line loops from Mitchell, Neb., to Washington station where oil was received into station tanks and relayed to Freeman station with the regular pumping equipment. Displacement was started February 28 and displacement scrapers arrived at Washington station April 9. Displacement of the line from Washington to Freeman was started April 14. Natural gas was used to propel the scraper to a location about 7 miles west of Freeman station where it lodged due to obstructions in the line. Displacement of the other parallel line from Washington to Freeman was started August 13 and completed September 1. Natural gas was used to propel the scraper from Washington station to Blue River, a distance of 29 miles, and water was used to propel the scraper from Blue River to

Author is superintendent of line maintenance, Service Pipe Line Co., Tulsa.



GRAPH AND FORMULA for calculating amount of gas needed for displacement. Fig. 2.

Freeman station, a distance of 132 miles.

2. Displacement of the Laton-to-Washington line was started April 4 and completed April 11. Natural gas was used to propel the scraper, and oil was received at Washington station and relayed to Freeman with two portable pumping units.

3. Displacement of the Valley Center-Humboldt line was started during the early part of August, and 6 days were required to complete the work.

Portable air compressors were used to propel the scrapers. These were assisted by a portable oil-pumping unit set at Elreco Junction to relay the stream until scrapers passed that location. Oil was received into the tanks at Humboldt station.

In the displacement of this line, two special displacement scrapers were used simultaneously. The first scraper separated the oil from a column of water (about 100 bbl.) which was moved through the line as a barrier between the oil and the compressed air. The second scraper was between the water and air.

Scrapers . . . Size 16, 12, 10, and 8-in. special six-cup displacement scrapers were built in the company's Tulsa shops for use in displacing these lines. Multiple-cup scrapers had proved satisfactory on previous jobs. These six-cup scrapers were constructed so that the draw bolts could be tightened to expand the diameter of the propelling cups and compensate for wear as the scraper moved through the line.

Each scraper was equipped with a pair of rowels which contacts the pipe and produced a sound which aided field personnel in following the scraper.

Fig. 3 shows the type of scraper used.

Gas Displacement of Mitchell to Washington 12 and 16-In. Line

Prior to starting displacement of oil in the Mitchell-Washington section, 30 tanks at intermediate stations were emptied. The contents were injected into the line plus a considerable amount of sediments and scale from the tank bottoms. Fort Laramie station continued pumping at a reduced rate in an effort to keep the stream moving during this tank-cleaning operation. However, crude stocks were urgently needed to fill the new Fort Laramie-Freeman 20, 22, and 24-in. line and the Wyoming crude stream was diverted into the new line before the displacement of the old line was started.

If the pumping could have been continued until the viscous crude was displaced, the sediment and scale probably would not have been a problem in the final displacement of the line with gas.

Low-pressure supply . . . North Central Gas Co. supplied gas for displacing the line from Mitchell station to Beck station; however, the rate was limited to about 500 M.c.f. per day and pressure fluctuated from about 105 to 215 psi.

Due to the limited pressure and quantity of natural gas available, two portable oil-pumping units were set at several locations along the line to aid in moving the oil.

Line displacement progressed according to plans until the displacement scraper approached Broadwater Junction about 55 miles east of Mitchell. Here it lodged due to heavy accumulations of basic sediment, pipe scale, and ice in front of the scraper. The line was tapped at this location and the heavy accumulations were discharged into a pit and burned.

After the line was displaced to Cormick Junction, the portable pumping units were moved to Keystone station to relay the stream to Washington. The line from Cormick Junction to 10 miles east of Keystone station traversed country with several high points which created a static head of about 75 psi.

It was evident that considerable b.s. and w. from the tank bottoms had collected in the low points on this section of the line.

It was difficult to keep the scrapers moving from Cormick Junction eastward with only 215 psi. gas pressure.

The scraper stopped at mile post 266.50 and it was necessary to tap and bleed the line to bleed off accumulation of basic sediment ahead of the scraper to dislodge it. The scraper stopped again at mile post 274.50 and it was necessary to tap the line again and install a steel bar ahead of it so that the line could be cut for inserting another scraper. This eliminated bleeding off a large volume of gas and minimized the possibility of an accident in cutting the line. A 2-in. line was installed to bypass the gas around the plugged section into the line behind the new scraper installed at this point.

From this location, the scraper moved past Beck and Cozad stations without further trouble.

Jetting dislodges scraper . . . After the scraper passed Beck station, Kansas-Nebraska Natural Gas Co. agreed to supply up to 1,400 M.c.f. of gas per day at 400 psi. This pressure increased the stream flow to about 725 bbl. per hour until the scraper lodged in the line about 12 miles west of Alfalfa Center ,due to heavy accumulations of basic sediment and scale.

The line was cut at this location and another scraper inserted. A 2-in. line was installed to bypass the gas around the plugged section and into the line behind the new scraper.

The scraper again lodged under the Chicago & Northwestern Railroad track near mile post 499.60. The line was tapped to install a bypass line to divert the gas pressure around the scraper and back into the line to break up the accumulations. This jetting action dislodged the scraper and it moved on to Washington station.

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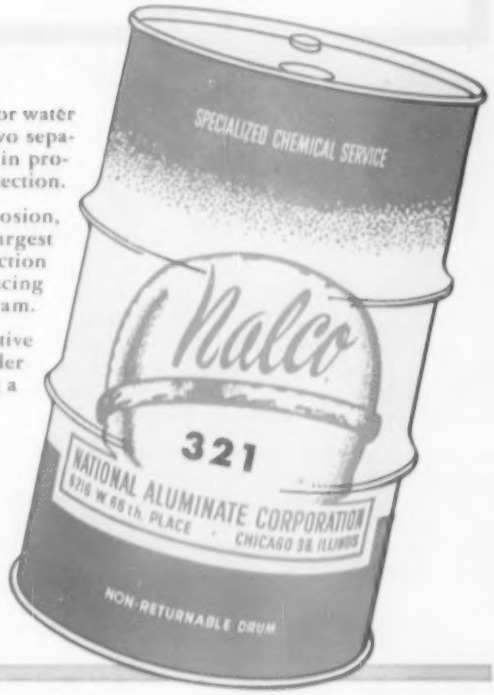

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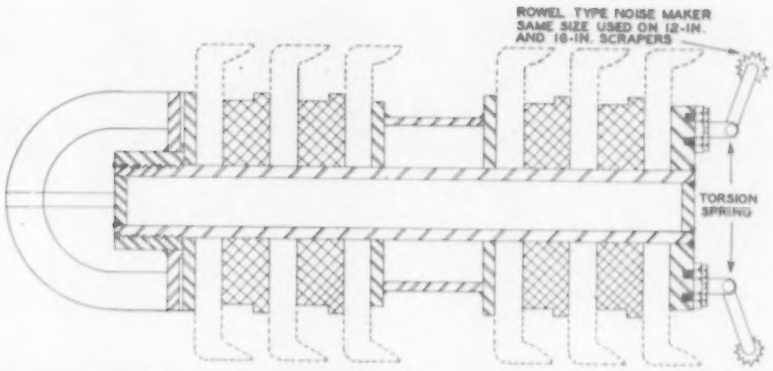

TYPE OF SCRAPER used in line displacement uses rowel noise makers, and has drawbolts for tightening cups. Fig. 3.

Washington to Freeman, No. 1 System

When the scraper arrived at Washington station the gas pressure in the line from Beck station to Washington station had been reduced to 240 psi. This volume of gas was used to displace the lines to Blue River. A high point east of Blue River caused a static head of 166 psi. which stopped scraper.

Arrangements were made then to obtain gas from Kansas Power & Light Co.'s 16-in. gas line. This additional volume of gas was sufficient to propel the scraper to the Kaw River where trouble was encountered again due to a high point east of the river. Pressure then was built up until the scraper moved on. The gas supply was then shut off, and the volume of gas in the line was sufficient to propel the scraper to a location about 7 miles west of Freeman station. The scraper stopped several times and it was necessary to tap the line at high points to bleed off accumulations of air that had been pushed ahead by the oil column.

Washington to Freeman, No. 2 System

After completing the tank-cleaning program at Washington and Elmont, only 15 days were left to displace the oil still in this system. To insure completion of the work on schedule, a 400-hp. diesel-engine-driven piston-type pump was set on the east side of Blue River for pumping water to displace the oil. This unit was filled with two engine-driven centrifugal pumping units which took suction from the river.

After the scraper in the 12-in. line passed Blue River, the pumping unit was started. It operated continuously for 8 days, pumping at the rate of 800 bbl. per hour at about 350 psi. The scraper in the 12-in. line arrived at Freeman August 22. A temporary crossover was installed east of the block valve at Stillwell Junction and water was transferred into the parallel 12-in. line to move the (lodged) scraper that had been previously propelled with gas to a point near Freeman station. The oil displacement was completed when the scrapers arrived at Freeman the evening of August 22. Displacing water from the line with compressed air was started immediately. This work was completed September 1 with the arrival of the scraper at Freeman.

To minimize the static head at high points so that the water could be displaced with compressed air, the line was tapped at several stream crossings and other water courses. However, precautions were taken to see that no oil was allowed to escape into the streams. To enable the foremen to coordinate the work with a minimum of time lost, the crews and equipment were moved after displacement in each loop was completed.

The urgency of completing displacement of the lines as scheduled September 1, entailed considerable extra cost due to overtime work of the crew personnel.

The high labor costs of displacing with gas, as shown on the cost sheets, were due to adverse weather conditions. Considerable time was consumed in locating and dislodging the scraper which stopped several times between Mitchell and Washington, and between Washington and Freeman. In one instance, 3 days were required to locate a scraper after it had lodged.

It was necessary to puncture the line at intervals until the scraper was located. Preparatory to puncturing the line to locate scraper, it was necessary to dig a bell hole and install a saddle-type nipple and full-opening gate valve on the pipe. The line was punctured by sliding a pointed drift punch through the gate valve and driving it into the line with a sledge hammer. Excavating was greatly facilitated using a tractor equipped with back hoe.

Laton-Washington Line

Gas supply for displacement of this line was limited to about 400 M.c.f.

TABLE 1—COSTS FOR DISPLACING OIL FROM OLD WYOMING LINE

Displace line with gas from Mitchell to Freeman:	
Field supervision and labor	$47,184
Expense accounts	6,426
Materials and supplies	4,502
Freight and hauling	183
Truck, car, and equipment expense	4,338
	$62,633
Natural gas used—40,482 M.c.f.	$12,442
In and out charges	840
	$13,282
Total	$75,915
Barrels of oil displaced with gas	528,661
Total cost of displacement	$75,915
Cost per barrel to displace with gas	$0.144
Displace line with water from Blue River to Freeman:	
Field supervision and labor	$4,315
Expense accounts	1,200
Materials and supplies	1,500
Freight and hauling	100
Truck, car, and equipment expense	4,064
Total	$11,179
Barrels of oil displaced with water	115,473
Total cost of displacement	$11,179
Cost per barrel to displace oil	$0.097
Displace water in line with air from Blue River to Freeman:	
Field supervision and labor	$3,488
Expense accounts	1,000
Material and supplies	1,500
Freight and hauling	100
Truck, car, and equipment expense	2,528
Total	$8,616
Barrels of water displaced with air	115,473
Total cost of displacement	$8,616
Cost per barrel to displace water	$0.075
Total cost per barrel to displace line	$0.172
Summary, Mitchell-Freeman lines:	
Total barrels of oil displaced	644,134
Total cost to displace	$95,710
Average cost per barrel for displacing line with gas and water	$0.148

TABLE 2—COSTS FOR DISPLACING OIL FROM LATON-WASHINGTON LINE WITH GAS

Field supervision and labor	$729
Expense accounts	179
Equipment expense	135
Natural gas—2,400 M.c.f.	600
Total	$1,643
Oil displaced (bbl.)	59,630
Cost per bbl. for displacing oil	$0.0276

TABLE 3—COSTS FOR DISPLACING OIL FROM VALLEY CENTER-HUMBOLDT LINE WITH COMPRESSED AIR

Field supervision and labor	$1,808
Expense accounts	226
Equipment expense	195
Air compressor expense	960
Freight and hauling	86
Total	$3,275
Oil displaced (bbl.)	44,410
Cost per bbl. for displacing oil	$0.0737

per 24-hour day at a pressure of 85 to 100 psi. This propelled the scraper at an average rate of 0.68 m.p.h. The line was displaced in 7 days. The high point on the line between the Solomon River and the Republican River considerably retarded movement of the scraper.

Gas purchased from the various companies for displacing the lines was tendered on an interrupted-service basis to assure adequate supplies for domestic and industrial consumption in the communities served by these firms. After the lines were displaced, all of the gas was released to the atmosphere at designated locations along the line.

Valley Center to Humboldt Line

Displacing this line with natural gas which was available from Cities Service Co.'s 16-in. gas line immediately east of Valley Center was considered. However, this would have necessitated constructing approximately ½ mile of 2-in. pipeline and crossing two railroads for interconnecting with Service Pipeline Co.'s 10-in. line at Valley Center Junction.

In view of the cost, estimated at $1,500 for connecting the gas, it was decided to utilize compressed air instead of natural gas. Two 315-cu.-ft. engine-driven portable air compressors were set at Valley Center Junction to propel the scraper through the line. After the scraper was inserted, about 100 bbl. of water was pumped into the line and a second scraper was inserted behind the water. Line was closed and air compressors were started August 7. Pressure was built up to 120 psi. but this was not sufficient to move the oil stream over the high point east of mile post 87 which is the divide between the Arkansas River basin and the Walnut River. A 6 by 6 portable pumping unit was set at Elreco Junction and connected to relay the stream around the block valve and to Humboldt station. This assisted the two air compressors to start the stream moving at Valley Center. After the scraper passed Elreco Junction, it was propelled by compressed air at an average rate of about ¾ m.p.h. No unusual difficulties were encountered in the displacement of this line.

Conclusion

Water has proved to be the most satisfactory medium for displacing oil or petroleum products in pipelines, as it is not limited to pressures or volumes like natural gas and compressed air. In using water, the rate of displacement can be calculated with a reasonable degree of accuracy. Also, portable pumps will develop pressures and volumes required to move the displacement scraper over extremely high elevations in a line. And, with ordinary safety precautions, the possibility of accidents is reduced to a minimum.

Under normal conditions and excluding overtime work by crew personnel, the cost of displacing lines with water, followed by displacing the water with air, would compare favorably with the cost of displacing with natural gas or compressed air.

The low cost per barrel for displacing the Laton-Washington line is attributed to the regular schedule of running scrapers while the line was in service. Also, the line profile has an average slope of 6.24 ft. per mile while only two high points which slightly retarded movement of the displacement scraper.

Cost per barrel and rate of displacement of the Valley Center-Humbodlt line was typical of several previous jobs where compressed air was used.

In the past Service Pipeline had displaced several hundred miles of pipe in other lines on its system. In many instances, water was used as the displacement medium, and compressed air has been used with good results. However, it has been a company policy when using compressed air to inject a column of water, possibly 100 bbl., into the line behind the oil-displacement scraper as a barrier between the oil and the compressed air.

The modern scraper propelling cup causes very little contamination or intermixing of the oil and water, or bypassing of air around the scraper.

In general, the scraper cleans the line satisfactorily without leaving pockets of oil at low points in the line. Contractors who took up the pipe in the old Mitchell-Freeman line reported that a small quantity of oil, possibly 10 or 15 bbl., was found at a few locations in the Washington-Freeman sector. Apparently, some defective valves in the intermediate junctions leaked oil from the operating line into the parallel line which had previously been displaced with gas and, in emptying the line of gas, the oil may have been carried along and deposited in the low points.

BOOKS

LEGAL PROBLEMS IN ENGINEERING. By Melvin Nord. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 391 pp. $7.50.

Subtitled "A broad, authoritative survey of those aspects of law which most concern the engineer," this book was written by an engineer who is also a practicing lawyer. It deals simply and concisely with most legal subjects which have a bearing on engineering.

Among the many topics covered are contracts, insurance, workmen's compensation, construction specifications, air and stream pollution, patents, copyrights, and government rgeulation of business. A concise review of the basic fundamentals of law and legal principles for engineers comprises the opening part of the book, and the remainder is devoted to professional problems of engineering and engineering-legal problems.

In all, this book should make a handy reference text for engineers, as well as a highly useful textbook in engineering colleges.

TWENTIETH ANNUAL MEETING, INDUSTRIAL HYGIENE FOUNDATION. Published by Industrial Hygiene Foundation of America, Inc., Mellon Institute, 4400 Fifth Avenue, Pittsburgh 13. 274 pp., paper back, $5.

A report of the twentieth annual meeting of this outstanding research organization. Articles concerning ever-changing concepts of industrial health and what industry is doing to provide better health conditions for

Note: The Oil and Gas Journal maintains a book department. Write to the READER personnel, with the help of this foundation. SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

NELSON REFINERY CONSTRUCTION INDEX

Appears in the Engineering Section in the first issue each month.
Compiled by W. L. Nelson, petroleum refinery consultant, Tulsa.
The Index was explained July 7, 1952 (page 105) as well as the Indexes of Individual Items of Equipment that appear on the Cost-imating page in the first issues of the months of January, April, July, and October.

Index (1946 = 100)

	1949	1952	1953	1954	1955	March 1956
Pumps, compressors, etc.	135.9	155.6	162.5	166.5	172.2	181.4
Electrical machinery	130.9	152.4	156.4	160.0	162.5	169.3
Internal-combustion engines	124.8	146.5	148.1	150.5	153.2	160.6
Instruments	123.1	146.2	151.8	154.6	162.9	180.3
Heat exchangers	133.0	165.8	174.9	171.7	156.8	188.0
Miscellaneous equipment average	*121.6	153.3	158.8	160.7	161.5	175.9
Materials component	143.6	164.3	172.4	174.6	176.1	186.5
Labor component	137.1	163.1	174.2	183.3	189.6	194.4
Nelson construction index	139.7	163.6	173.5	179.8	184.2	191.2

*Used in computing the Nelson Index until April 1952. This is slightly different from the average of the Miscellaneous Equipment Items shown above.

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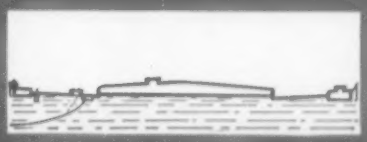

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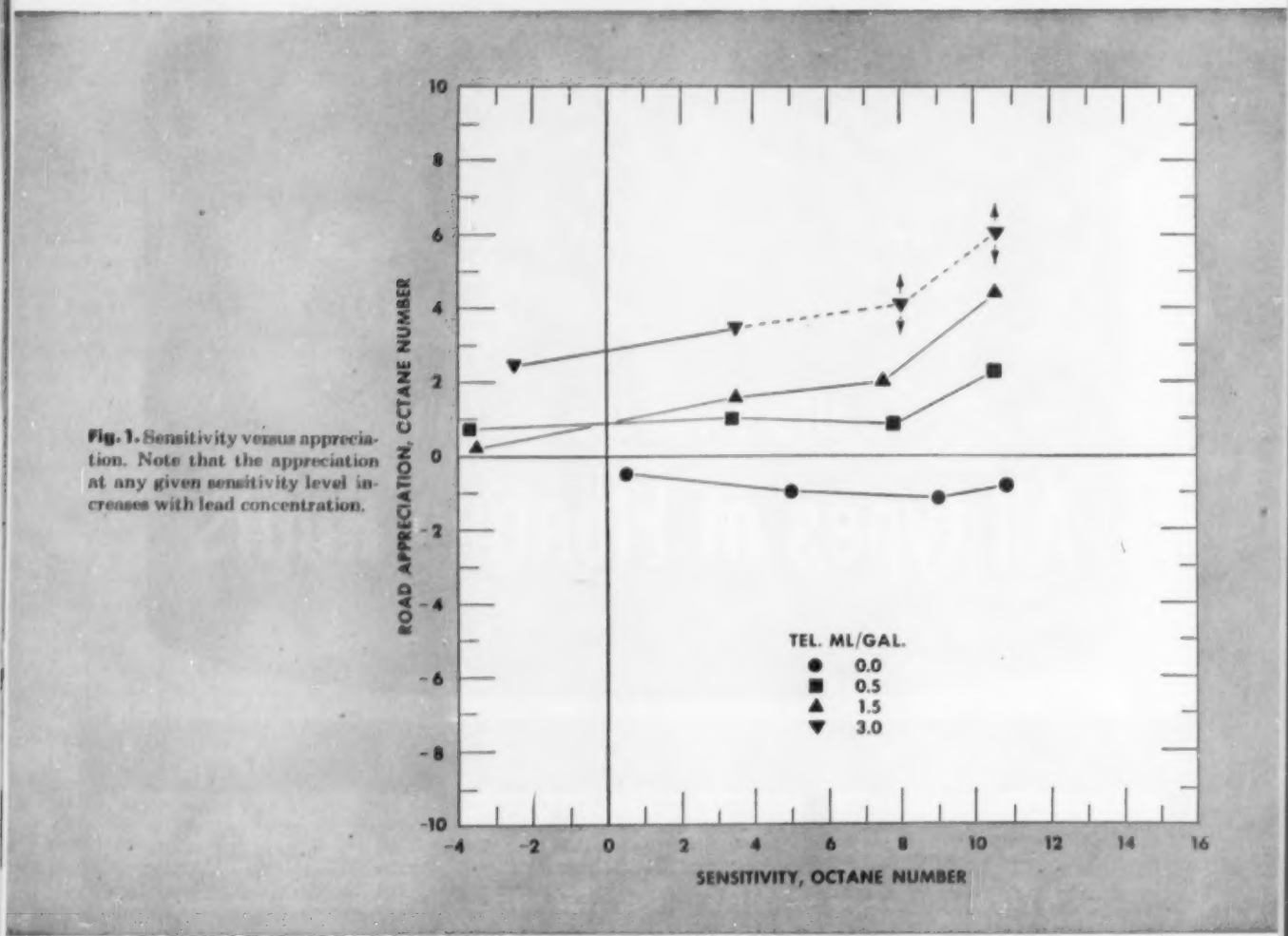

Fig. 1. Sensitivity versus appreciation. Note that the appreciation at any given sensitivity level increases with lead concentration.

Blending Hydrocarbons for
Maximum Octane Potentials

By F. D. BUERSTETTA
Ethyl Corporation, Detroit, Mich.

The manufacture of high-octane gasolines to meet today's and tomorrow's automotive demands is putting increasing pressure on the refiner. To meet these requirements, the available hydrocarbon components in the refinery must be blended to best advantage to give maximum performance on the road.

Each octane number at the 100-octane level may cost as much as 15 to 20 cents per barrel. Thus there is a marked incentive for insuring that every laboratory octane number, obtained at this great expense, provides corresponding antiknock performance in cars on the road.

Hydrocarbon blends studied

As part of a continuing Ethyl Research program to establish the fundamentals of laboratory versus road antiknock quality, a study was recently conducted in which the behavior of blends of pure C_7 and C_8 hydrocarbons was examined.

Within this C_7-C_8 range, the four basic hydrocarbon types—olefins, paraffins, naphthenes and aromatics—were blended in varying proportions. Actually, a mixture of isooctane and *n*-heptane was used as the paraffin constituent to permit maintenance of a constant Research octane number while investigating the effects of tetraethyllead concentration and variations in hydrocarbon-type composition. Toluene, diisobutylene and methylcyclohexane were selected to represent the aromatics, olefins and naphthenes, respectively. Each of these hydrocar-

Send for your free copy of a technical paper entitled "Octane Possibilities with C_7-C_8 Hydrocarbons" by F. D. Buerstetta and T. W. Warren. Address your request to Box 21, Ethyl Corporation, 100 Park Avenue, New York, N.Y.

bons was blended in concentrations of 20, 40 and 60 per cent by volume with the proper paraffin mixture, giving nominal Research octane levels of 92, 96 and 100 at each of four tetraethyllead concentrations—0.0, 0.5, 1.5 and 3.0 ml. per gallon.

Each blend was evaluated in single-cylinder laboratory test engines and was then rated in the 9 to 1 compression-ratio engine of a 1955 passenger car equipped with an automatic transmission. Road ratings were made by both the Modified Uniontown and Modified Borderline techniques.

Road appreciation defined

Some of the test results are summarized in Table 1 in terms of road appreciation, which is the road antiknock rating of a fuel minus its Research octane number—or the bonus obtained in actual engine performance over the indicated laboratory knock rating.

The general analysis of data shown in Table 1 may permit a refiner to achieve better road performance than could be secured by using only Research octane number as a guide. It will be seen that aromatics should be maximized and olefins minimized as much as possible when making top-octane fuels. Since most of today's catalytic reforming processes eliminate naphthenes through dehydrogenation to aromatics, consideration of them is somewhat academic, but nonetheless interesting.

Further evaluation of the large quantity of test data obtained from this project indicates a most interesting correlation between appreciation and the concentration of tetraethyllead. Figure 1 shows a plot of sensitivity versus appreciation with points representing the same tetraethyllead concentrations connected. It can be seen from Figure 1 that the appreciation at any given sensitivity level increases with lead concentration.

Conclusions

The general conclusions which can be obtained from the study are as follows:

1. Best over-all antiknock performance can be obtained by blending a high proportion of aromatics with paraffins and adding the maximum amount of tetraethyllead.

2. Where low-speed knock resistance is critical, high aromatic content is necessary.

3. Where high-speed antiknock performance is critical, high aromatic content is less important, but maximum tetraethyllead concentration is still essential.

Table 1. Average change in road antiknock appreciation with addition of aromatics, olefins or naphthenes to paraffins in the C_7-C_9 range.

Research Octane No.	Added Component	Modified Uniontown	Modified Borderline	
			Low Speed	High Speed
92	Aromatics	+0.6	+1.1	+0.6
	Olefins	+0.3	+1.1	−2.0
	Naphthenes	+0.6	+2.0	+3.8
96	Aromatics	+0.9	+1.7	+0.6
	Olefins	+1.6	+1.1	−3.3
	Naphthenes	+2.4	+4.2	+2.7
100	Aromatics	+0.8	+1.5	−0.7
	Olefins	+0.5	+0.0	−5.7
	Naphthenes	+3.4	+3.7	+1.7

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At today's high octane levels, the science of blending hydrocarbons has taken on more and more importance. As a service to the oil industry, Ethyl Research has launched a hydrocarbon blending program of its own to complement the intensive effort which the industry is devoting to this problem.

We are now testing many new blends in our laboratories and in high-compression engines on the road. Much of the data from these tests is being interpreted in terms of "road appreciation" to give refiners a better idea of the effectiveness of each blend. Write for a copy of "Octane Possibilities with C_7-C_8 Hydrocarbons"—another in the continuing series of reports from the Ethyl Corporation on fuel blending and other studies of vital interest to refiners today.

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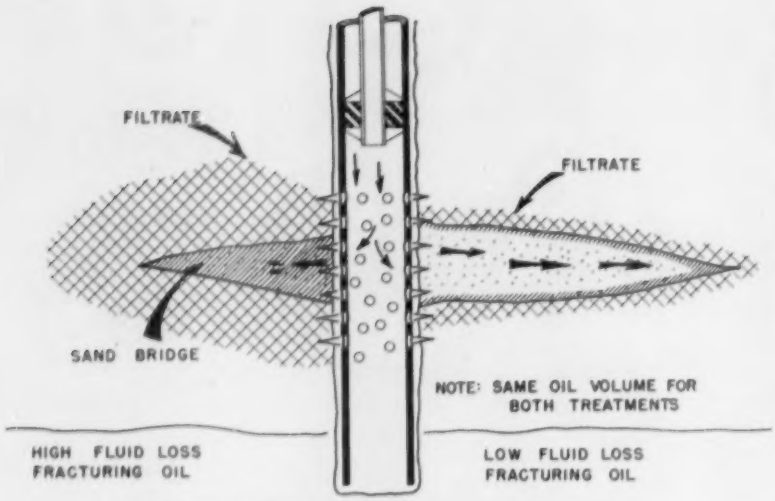

EFFECT OF FLUID LOSS on fracture extension. Fig. 1.

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Control That Fluid Loss

- Experimental fracturing results show that fluid loss is critical in fracture extension.
- Field results indicate that, productionwise, treatments with low-fluid-loss fracturing fluids give better results than do conventional treatments of equal size.
- Calculations and field results illustrate that fluid-loss control has more effect on fracture extension than either the injection rate or the viscosity of the fracturing fluid.

by J. G. Davis, J. J. Reynolds, and H. F. Coffer

THE importance of low fluid loss is rapidly being recognized by the industry. Several thousand wells have been fractured using lease crude with a controlled fluid loss. Fewer sandouts are encountered and production increases tend to be more sustained. The converted oils have performed very well in formations that have been difficult to fracture in the past. Such formations include chats and conglomerates and reservoirs with temperatures in the 200° to 300° F. range.

Both laboratory and field results have shown that crudes treated to reduce the fluid loss are fully compatible with the various gelling materials now available. The very low-fluid-loss gel that results from this combination is advantageous in many instances. With proper treatment design, the selection of crude oils is now almost unlimited.

Authors are with Continental Oil Co., Ponca City, Okla.

Background of Fracturing

The development of the hydraulic-fracturing process has occupied only a few years in the history of the oil industry.[1,2] During this brief period, however, fracturing has become the major method for production stimulation and its application has led to the reopening of many oil fields formerly classed as depleted.[3]

The techniques of fracture creation and the orientation of the resulting fracture systems have been the subject of several papers.[1,4,5] The authors believe that two types of fractures (with respect to orientation) can be created within limits imposed by well and formation conditions. The first is the conventional or horizontal fraction. It is produced through the use of a highly penetrating breakdown fluid. The second type or vertical fracture is dependent upon confining the pressure to the well bore during the breakdown phase of the treatment.

Fluid loss affects all . . . The selection of the proper breakdown fluid then becomes important in determining the orientation of the fracture that will be created. Fracture extension once the break occurs, however, will be dependent upon the properties of the treating fluid and will be discussed here as a separate problem.

Mechanics of Fracture Extension

If the formation of the initial fracture, either horizontal or vertical, is disregarded and only the fracture extension is considered, it is apparent that the length of fracture per specified gallonage treatment will be governed by the treating fluid and the rock permeability. As the fracture is extended, the contact area between the matrix rock and the fracturing fluid is increased. Regardless of the type fluid used, the amount of fluid lost to the matrix will increase proportionately with the area of rock exposed. If a fracturing fluid of high fluid loss is used, more fluid will be lost to the matrix per unit area and a shorter fracture will result from equal-size treatments. Fig. 1 illustrates qualitatively the effect of fluid loss on fracture extension.

A high-fluid-loss oil does nothing to seal off the face of the fracture while the fracture is being extended. With such oil, the maximum depth of fracture formed for a specified treatment size will be dependent upon the pumping rate, permeability of the sand, fluid viscosity, pressure differential between the fracturing fluid and reservoir fluids, and the volume of fluid necessary to fill the fracture. By utilizing Darcy's equation for fluid flow, an approximation relating maximum fracture length with the rate of fluid loss to the matrix can be derived. (See appendix for complete derivation.) This may be expressed as:

$$Q = 0.0312\ R^2\ [(K_v \Delta P)/\mu T]^{1/2}$$

Where:

Q = G.p.m. of fluid lost from the fracture

K_v = vertical permeability of formation (md.)

μ = viscosity of fracturing fluid (cp.)

ΔP = pressure drop between fluids in

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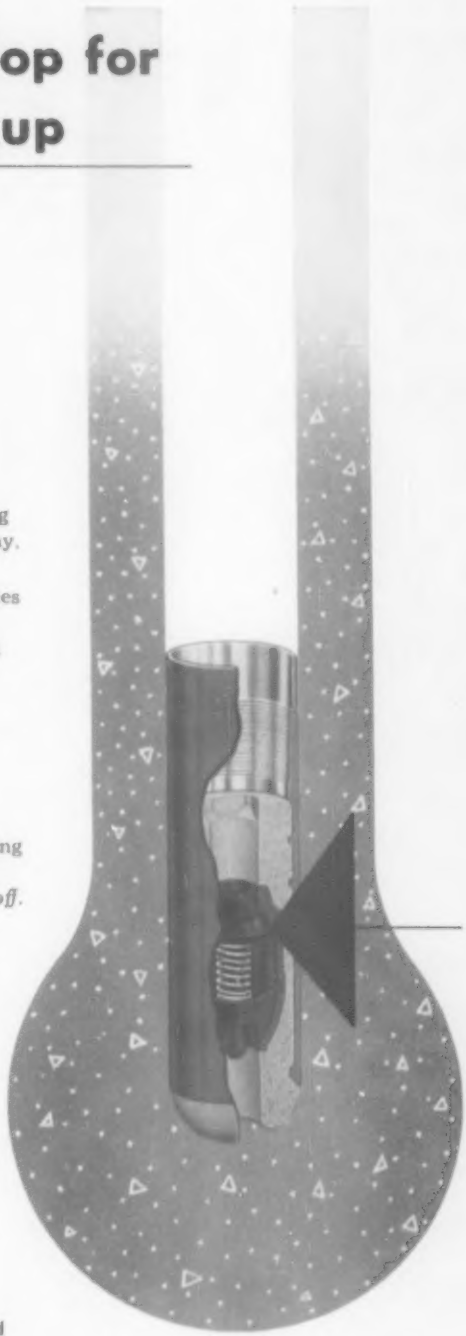

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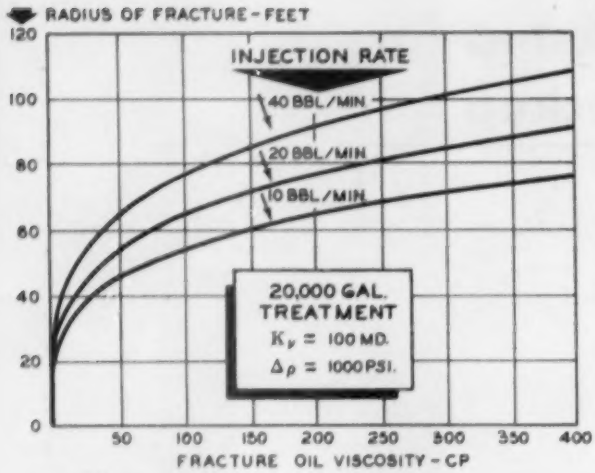
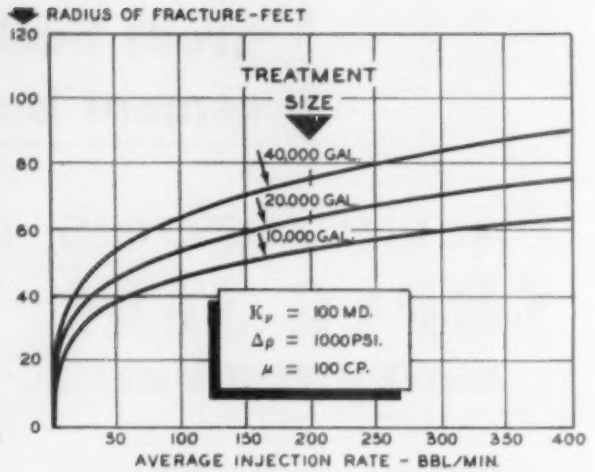


EFFECT OF VISCOSITY on fracture extension. Fig. 2.



EFFECT OF INJECTION RATE on fracture extension. Fig. 3.

fracture and fluids in formations (psi.)

T = total time required for treatment (minutes)

R = radius of fracture (ft.)

The derivation neglects the volume of oil remaining in the fracture and assumes the following:

1. Linear flow from the fracture to the formation prevails.

2. Porosity of the formations = 20 per cent.

3. K_v, ΔP, and μ remain constant throughout the treatment.

4. Flow is from both sides of the fracture into a porous medium empty of liquid.

5. The fracturing fluid is in contact with the formation surfaces for equal intervals of time throughout the length of the fracture.

6. Only one fracture is extended and this is perpendicular to the axis of the well bore.

The maximum radius of fracture will be attained when the rate of fluid loss from the fracture is equal to the injection rate at the surface. The equation may be written as:

$$R^2_{max} = \frac{I}{0.0312\ [(K_v \Delta P)/\mu T]^{1/2}}$$

Where:

I = surface injection rate, g.p.m.

Radius is limited . . . Using this equation, three sets of curves, Figs. 2, 3, and 4, are given which show the effect of fluid viscosity, pumping rate, and treatment size on the maximum radius of the fracture.

Fig. 2 illustrates the effect of viscosity on fracture extension at constant treatment size and pumping rate with K_v = 100 md. and ΔP = 1,000 psi. From the graph, it is apparent that even at a bottom-hole viscosity of 400 cp. and a pumping rate of 40 bbl. per minute, the maximum radius of fracture from a 20,000-gal. treatment is 110 ft.

Fig. 3 shows the effect of pumping rate on the radius of fracture when treatment size is held constant. For these calculations, K_v = 100 md., ΔP = 1,000 psi., and μ = 100 cp. These curves show that only a 90-ft. fracture could be obtained by a 40,000-gal. treatment at a pumping rate of 40 bbl. per minute with a 100-cp. viscosity fluid.

These results show that there are pronounced limitations on the amount of fracture that can be obtained using a sand-carrying fluid which has no retentive properties and flows into the matrix restricted only by its viscosity. To illustrate this even further, Fig. 4 shows the effect of treatment size on fracture extension. For these calculations, K_v = 100 md., μ = 100 cp., and ΔP = 1,000 psi.

Fig. 4 shows that at an injection rate of 40 bbl. per minute and a treatment of 40,000 gal., the fracture created will only be 90 ft. in radius. At 20 bbl. per minutes a fracture of 77 ft. is possible, and at 10 bbl. per minute the fracture radius would be only 65 ft. Actually these results are high, as are those from Figs. 2, 3, and 4, since they assume that none of the fluid is used up in filling the fracture.

Low fluid loss better . . . The size of fracture possible with a fracturing fluid which seals off the face of the matrix as it creates the fracture suffers less limitation. By assuming a fracture width of 0.2 in. and that a definite amount of fluid is lost across each unit area of the fracture face, values for the depth of fracture created by a low-fluid-loss fracturing fluid can be calculated. Fig. 5 presents a set of such curves with total fluid-loss values of 10, 20, and 40 cc. assumed across an area equivalent to the area of the A.P.I. Code 29 test cell. These calculations take into account the volume of fluid retained in the fracture.

As seen in Fig. 5, the fracture radius is dependent upon the fluid loss and the volume of the treatment. For example, a 20,000-gal. treatment with a 20-cc.-fluid-loss fracturing fluid would give a fracture 140 ft. in radius. Further, it may be shown that a 73,000-gal. treatment with a 10-cc.-fluid-loss oil would yield a fracture with a 330-ft. radius. This would extend the fracture to what is normally assumed to be the radius of drainage on a 10-acre spacing pattern.

A comparison of the data from Figs. 2, 3, 4, and 5 shows that fluid-loss control is more important than either viscosity or injection rate when deeper fractures are desired. For example, 10,000 gal. of a 20-cc.-fluid-loss fracturing fluid at a low injection rate will create a 98-ft.-radius fracture, 14 per cent longer than the 86-ft. fracture which could be obtained by a 20,000-gal. treatment with a 100-cp. oil at an injection rate of 40 bbl. per minute.

Field Results

Extensive field testing has been done to demonstrate the contribution of low fluid loss to fracture extension. Among the more significant work was a series of three controlled experimental sand-out fracturing operations performed in Oklahoma. Fluid-loss effects in these operations were isolated through the selection of wells having very similar formation characteristics and through the use of comparable treating factors (tubing size, injection rate, etc.). In all cases, the actual breakdown was

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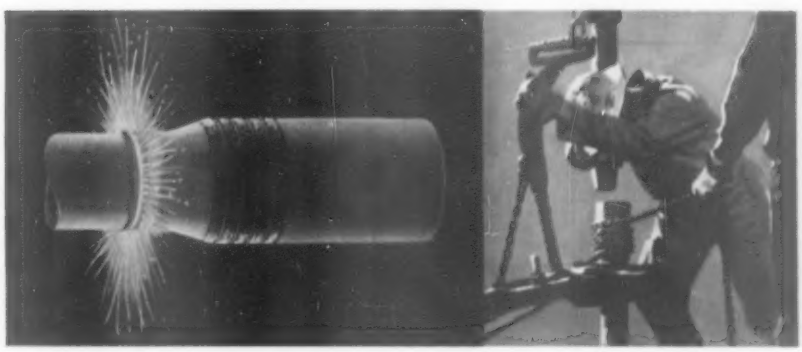

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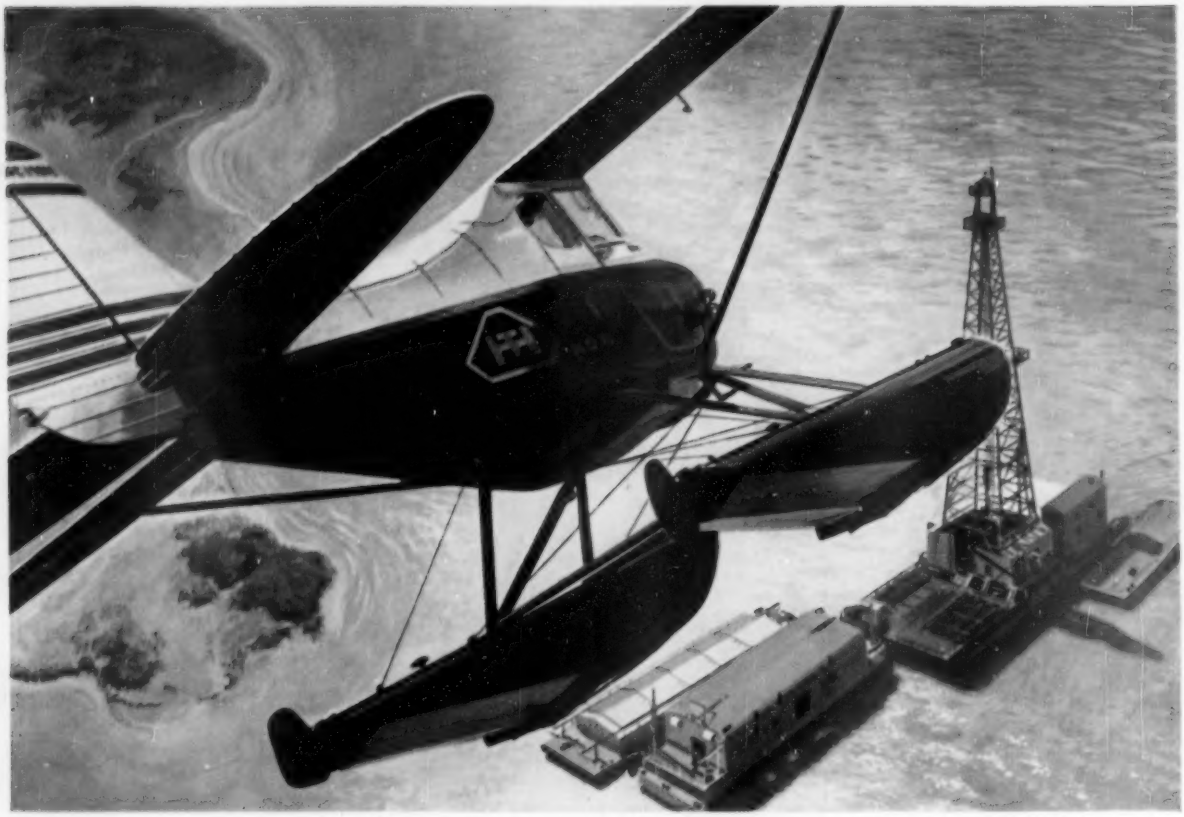

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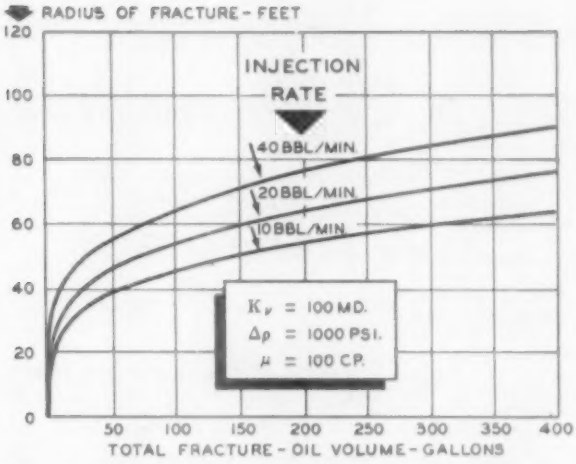
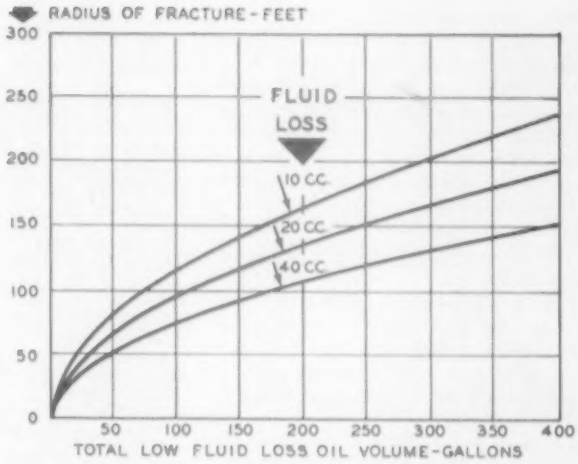


EFFECT OF VOLUME of high-fluid-loss oil on fracture extension. Fig. 4.



EFFECT OF VOLUME of low-fluid-loss oil on fracture extension. Fig. 5.

accomplished with high-fluid-loss lease crudes.

The first well was fractured using a high-fluid-loss lease crude with a 12-cp. viscosity. A break was created and the sand-oil mixture at an initial concentration of 0.5 lb. per gal. was pumped in at 4 bbl. per minute. The ratio was increased at 1,000-gal. intervals to 1.0, 1.5, 2.0, 2.5, and 3.0 lb. per gal. A sandout started when the 3.0-lb. sand-oil reached the formation. The well bore was cleaned out and the sandout was broken with the same crude oil after the oil had been treated with an additive to give a low fluid loss. The injection rate used to start the sand moving again was 1 bbl. per minute.

Higher sand concentration . . . The second well was broken down with lease crude and then treated with a low-fluid-loss crude at an injection rate of 4 bbl. per minute. Sand concentration was increased in the same manner as in the first well. With the low-fluid-loss oil, however, the sandout did not occur until an additional 1,000 gal. carrying 4 lb. of sand per gal., 1,000 gal. carrying 6 lb. per gal., and 1,300 gal. carrying 8 lb. of sand per gal. had entered the formation. A total of 30,000 lb. of sand was put away.

Again in the third well, injection rates were restricted to a constant 4 bbl. per minute. After breakdown with lease crude, the low-fluid-loss oil was used and the sand concentration rapidly built up to 4 lb. per gal. and held at this point. A sandout finally occurred after a little over 48,000 lb. of sand had entered the fracture. The 4-lb. per gal. concentration was selected because a sandout had occurred with a high-fluid-loss oil at a concentration of 3 lb. per gal.

The experimental fracture series was conducted at the low injection rate deliberately to accentuate the fluid-loss effects. No gelling or other thickening agent was used. The treated, low-fluid-loss oil had a viscosity of only 15 cp. compared to the 12 cp. of the untreated crude used in fracturing well No. 1. The test showed, at least for this particular formation, that the sand-carrying and fracture-extending abilities of a fracturing fluid could be greatly enhanced by treating the oil to give it a low fluid loss without resorting to either high injection rates or a high viscosity. It should not be construed from this, however, that viscosity is unimportant, since the sandout at 48,000 lb. probably resulted from the inability of the very low-viscosity fluid to move the sand grains after the fracture radius had reached a point at which the fluid velocities were extremely slow.

Overcomes sandout . . . Another test was conducted in Kansas where a well intentionally was sanded out using a high-fluid-loss lease crude oil at a 4-bbl. per minute injection rate. The sandout occurred in this case after only 900 lb. of sand was displaced. An attempt to reopen the fracture using a high-viscosity high-fluid-loss refinery residual failed. Again the lease crude, ungelled and treated to give a low fluid loss, was successful in moving the sand. An additional 5,000 lb. of sand was put away at 3 bbl. per minute using the treated crude. This experiment illustrated the importance of confining the fluid to the fracture by showing the ineffectiveness of increasing viscosity without adequate control of the fluid loss.

Additional comparisons are available from the fracturing of specific conglomerate formations in Kansas and North Texas. Treatments in these formations using refinery residuals and gelled oils ran from 500 to 2,500 lb. of sand before sandouts occurred. Low-fluid-loss, low-viscosity oils were successful in both areas in putting away treatments of 4,000 to 6,000 lb. of sand without difficulty.

Further evidence is obtained from Louisiana where attempts to fracture with lease crude oils had been unsuccessful. The same oils, when confined to the fractures by reducing the fluid loss, are giving good fracture treatments.

High temperature . . . Another illustration of the effectiveness of fluid-loss control was the operation in South Texas when 8,000-ft. wells were fractured at 4 bbl. per minute injection rates using a 40° A.P.I. crude oil treated to give a low fluid loss. The viscosity in this case was 2 cp. at the bottom-hole temperature of 245° F. Treatments of 10,000 lb. were accomplished. This formation, incidentally, had been very difficult to fracture using other types of sand-carrying fluids.

Low-fluid-loss oils in some areas of West Texas have been used successfully at reduced injection rates to replace the very high injection-rate treatments. Here again is demonstrated the importance of containing the fluid in the fracture system.

Further indications of increased extension efficiency may be seen in several areas where conventional fracturing treatments are normally very large. Low-fluid-loss oils have been used in many instances in conjunction with a 50 per cent reduction in treatment size. Production results show the reduced treatments to be as good or better than the large treatments.

Sustained increase . . . Data are becoming available that indicate that the production increases in wells fractured

with low-fluid-loss oils are often more sustained than those obtained by equal-size treatments with conventional fluids. This again may be interpreted as an indication of deeper penetration of the fracture into the reservoir. The data are not confined to any one type of formation or of fracture since low-fluid-loss oils have been used successfully in all types of reservoirs and with both horizontal and vertical fracturing treatments.

As an illustration of sustained increase, the first use of a lease crude with a controlled fluid loss for fracturing was in June 1954. Production rates went from a prefracture value of 8 bbl. per day to a settled rate of 50 bbl. per day. This is certainly no startling increase; however, 10 months later the production was still in the vicinity of 47 or 48 bbl. per day.

Another case is a Kansas well that had been fractured on completion and again at a later date, both times by conventional means. When production once more declined, the well was fractured for the third time. A low-fluid-loss oil was used and the well returned flowing over 200 bbl. per day.

Fluid-Loss Control

The extensive field testing that has been done using both high and low-fluid-loss and high and low-viscosity oils illustrates the important part played by fluid-loss control in hydraulic fracturing. There is now little doubt that the fracture process will attain its highest efficiency when every barrel of fluid injected at the surface is utilized to extend the fracture deeper into the reservoir.

The conclusions reached in this article are based almost entirely on the results of the field work that has been done with low-fluid-loss oils. Curves constructed on a basis of the equation presented are subject to severe limitations and are intended only to show a general trend that is borne out by field results.

Much of the experimental work that has been done involved ungelled low-fluid-loss crude oils. Both laboratory and field results indicate, however, that in many instances even better results will be obtained by the use of a gelling agent along with a fluid-loss controlling agent. Such a fluid seems to approach the optimum for fracturing since the combination provides for both the retention of injected fluid in the fracture system and the ability to move sand with ease deep in the fracture.

Acknowledgment

The authors wish to thank the production personnel of Continental Oil Co. whose helpful suggestions and cooperation made the field trials possible. They also thank the management of Continental Oil Co. for permission to publish this paper.

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APPENDIX

Derivation of Radius of Fracture Equation

Let:

- Q = instantaneous volume rate of flow into formation (g.p.m.)
- I = average surface injection rate throughout treatment (g.p.m.)
- V = total volume of treatment (sand not considered) (gal.)
- t = time since start of treatment (minute)
- K_v = vertical permeability of formation (md.)
- A = area of formation exposed by the fracture (ft.^{2})
- ΔP = pressure drop between fluids in fracture and fluids in formation (psi.)
- l = length of flow path in formation (ft.)
- μ = viscosity of fracturing oil (cp.)
- ϕ = porosity of formation (dimensionless)

Assumptions:

1. The volume of oil remaining in the fracture is neglected.
2. Linear flow from the fracture to the formation prevails.
3. Porosity of the formation = 20 per cent.
4. K_v, ΔP, and μ remain constant throughout the treatment.
5. Flow is from both sides of the fracture into a porous medium empty of liquid.
6. The fracturing fluid is in contact with the formation surfaces for equal intervals of time throughout the length of the fracture.
7. Only one fracture is extended and this is perpendicular to the axis of the well bore.

Darcy's linear flow equation:

$$Q = \frac{dv}{dt} = \frac{K_v A \Delta P}{\mu l}$$

Where:

- Q = cc. per second
- K_v = darcies
- A = cm.^{2}
- ΔP = atm.
- μ = cp.
- l = cm.

Converting to desired units:

$$Q = dv/dt = (3.29 \times 10^{-5}) \times \frac{K_v A \Delta P}{\mu l} \text{ (g.p.m.)} \quad (1)$$

Volume of fluid lost to the formation:

$$v = A \phi l$$

$$v = 7.48\ A \phi l \text{ (gal.)} \quad (2)$$

Then:

$$dv/dt = 7.48\ A \phi\ dl/dt \quad (3)$$

Equate Equations 1 and 3:

$$ldl = (4.40 \times 10^{-6}) \frac{K_v \Delta P}{\mu \phi} dt \quad (4)$$

Integrate Equation 4:

$$\int_{l=0}^{l=L} ldl = (4.40 \times 10^{-6}) \times (K_v \Delta P)/(\mu \phi) \int_{t=0}^{t=T} dt$$

$$L^2 = (8.80 \times 10^{-6}) \frac{K_v \Delta P}{\mu \phi} T \quad (5)$$

Substitute L of Equation 5 into Equation 1 to obtain the rate of flow at time T:

$$Q = 0.0111\ [(K_v A^2 \Delta P \phi)/\mu T)]^{1/2} \quad (6)$$

If it is assumed that the formation is exposed on both sides of the fracture and that the fracture is oriented perpendicular to the axis of the well bore:

$$A = 2 \pi R^2 \quad (7)$$

Where:

- R = radius of fracture (ft.)

Therefore, from the Equation 6:

$$Q = 0.0697\ R^2\ [(K_v \Delta P \phi)/\mu T]^{1/2} \quad (8)$$

Assume $\phi = 0.20$.

Then:

$$Q = 0.0312\ R^2\ [(K_v \Delta P)/\mu T]^{1/2} \quad (9)$$

The fracture radius will be at a maximum value when the rate of fluid flow from the fracture is equal to the rate of fluid injection at the surface. ($Q = I$).

Therefore, if only one fracture is extended:

$$R^2_{max} = \frac{I}{0.0312\ [(K_v \Delta P)/\mu T]^{1/2}} \quad (10)$$

Here's a suggestion for an improved method of

Calculation of Oil in Place in Reef Reservoirs

The procedure advocated is quite simple. Instead of selecting an arbitrary point of delineation between pay and nonpay, all porosity, permeability, and connate-water values would be totaled and a gross average obtained for each

by Richard W. Hillyer

THERE are weaknesses in our volumetric analysis of reef oil reserves. These weaknesses are caused by a tendency to forget that the volumetric techniques utilized were developed for sandstone reservoirs, whereas the material composing the reef is of quite different characteristics.

In addition to the volumetric calculation of oil in place, there are techniques of theoretical calculation, analysis of production history, and parallel reservoirs, or combinations of all methods.

Normally, the volumetric method is less relied upon than others. Unfortunately, this is not true when dealing with reef reservoirs. The large size of the major reefs means that in most cases the per cent depletion is so low as to render insensitive the usual mathematical approaches. Similarly, the relatively recent discovery of reefs as hydrocarbon reservoirs prevents wholesale comparisons with known depleted reservoirs. Hence, the necessity to refine our volumetric calculation as much as possible.

Usual analysis . . . The usual volumetric analysis of a reef reservoir is as follows: Reef tops are selected from electrical logs, and a base of pay, usually a water table, is selected based on completion information, tests, and logs. From these data an isopachous map of gross reef thickness is constructed from which the total acre footage of the reef is determined.

Next all core data, gamma ray-neutrons, and MicroLogs are examined and on the basis of these criteria the reef section evaluated foot by foot as to porosity and permeability. Then, on some arbitrarily assumed division point, these footages are classified as productive or nonproductive. The number of total feet of productive reef is converted to a percentage of total analyzed footage and this percentage classed as "per cent net of gross."

Then, by use of the analytical data for only those samples classed as productive, an average net porosity and net connate water are calculated. The unit oil in place is calculated as barrels per net acre-foot, and this number is multiplied by the gross acre-foot, which quantity is in turn multiplied by the "per cent net of gross" for total oil in place. A recovery factor is then applied to this number and ultimate recoverable oil is calculated.

How Reefs Are Formed

Is this method accurate? Let us review the formation of a reef reservoir and see.

Reefs are formed in a different manner from any other known type of reservoir. The reef forms in warm tropical waters. A relatively rigid framework of living coral and algae is constructed in a vertical direction, as opposed to the depositional-type formation of the other types of carbonate reservoirs. The marine conditions necessary for the construction of the reef framework are ideal for other forms of marine life so that the area of the reef being formed literally teems with life.

Results are that the semirigid reef framework fills with organic materials from these exterior life forms, and builds as a mass composed of almost completely organic matter. As the reef grows, primary porosity and permeability are present in the myriad openings inside the shells of the reef-form-

PRODUCING

TABLE I—WEST TEXAS REEF "A"—VOLUMETRIC RESERVES BY GROSS ANALYSIS

Wells analyzed by cores—	Reef gross feet above oil-water contact	Gross feet cored	Cored section total porosity (ft.)
Operator A:			
Well 3	487	142	888.85
Well 24	307	55	502.60
Well 2	431	87	800.21
Well 23	99	15	52.40
Well 12	186	17	107.89
Well 5	424	178	1,109.45
Subtotal	1,934	494	3,461.40

Wells analyzed by neutron interpretation—	Reef gross feet above oil-water contact	Gross feet cased and analyzed	Total porosity (ft.)
Operator B:			
Well 1	166	91	819.4
Well 2	105	39	374.8
Well 3	116	14	245.0
Well 4	70	17	278.8
Well 5	98	30	510.0
Well 6	71	10	60.0
Subtotal	626	201	2,288.0
Grand total	2,560	695	5,749.4

Recovery calculations:	
Average gross porosity	8.3
Average gross connate water	36.4
Oil originally in place per gross acre-foot: 7,758 (.083) (.636) ÷ 1.524	269
Total gross acre-feet	493,372
Total oil in place originally: 493,372 × 269	132,717,069
Recovery factor, per cent	45
Originally recoverable oil, bbl.	59,722,681

ing creatures left by the decomposition of the soft bodies of these tiny beings.

Other factors . . . There are also, in the decomposing surface of the reef mass, many boring mechanisms—worm-like creatures, which bore holes in search of food. These creatures add their bodies and their secretions, as well as their residual holes, to the reef. Further, as the reef mass grows, some to hundreds of feet in thickness, the weight of the deposit causes it to settle, which in turn causes fractures and fault systems to form within the reef itself.

The warm percolating sea waters fill some holes with cementing $CaCO_3$ and leach out others. Waves wash caverns out. Variations in climatic conditions stop reef building. During these periods primary portions of the reef erode and fall as talus, or are transported. The reef grows, having primary intergranular porosity and permeability, vugular porosity, solution channels, fractures, and bored holes.

Conditions favorable to reef formation change, and building ceases. Sedimentation over the reef begins and alteration of the reef also begins to take place. Compaction and percolating waters add to the changes in construction of the reef which were occurring during formation. Some permeability channels become tightly cemented; others are leached. Fractures fill with chemical limestone and other fractures form as continued settling takes place. The reef alters. Diagenesis occurs.

Present structure . . . After geologic ages pass, man sinks a drill bit into the reef mass which now contains hydrocarbon deposits. The reef mass by now is one of pore space such as vugs ranging from pin point to cavernous in size, solution channels, joints, fractures, and intergranular and intercrystalline pore spaces. Some of these openings are superimposed and interconnected; others are discontinuous. In short, the reef mass porosity and permeability is heterogeneous.

With the concept of a reef fresh in mind, it is of value to examine the previously described method of evaluation of oil in place.

What was the essence of the method? Fundamentally, it was based on core analysis, evaluation of gamma ray-neutron logs as calibrated to core data, and to MicroLog selection of permeable sections. In the light of the above review of reef-mass composition, to anyone familiar with these tools it may readily be seen that these criteria are inaccurate for void-space analysis.

Sources of error . . . All of us know that for routine core analysis, the laboratory must cut solid plugs, that is, without large vugs, joints, or fractures, from the core in order that analysis may be done with routine methods. Thus we get a report which is basically representative of porosity and permeability of the intergranular and intercrystalline type, and only slightly representative of other types. These core data are calibrated to the gamma ray-neutron and we similarly read the same type of porosity and permeability from that tool.

MicroLogs similarly read principally intergranular and intercrystalline porosity and permeability, and rather inadequately in many cases at that. For example, in one well where various methods of analysis were available, the MicroLog indicated some 65 ft. of "net" permeable footage as compared to a core analysis-based method of 115 ft. of "permeable" section. The use of MicroLogs in evaluation of reefs is subject to many errors.

The use of this method makes the basic assumption that fundamentally the only effective porosity and permeability is that found in the intergranular and intercrystalline spaces of the reef, and that all other porosity and permeability can be ignored. Anyone who has examined many feet of reef cores or who has studied available reef behavior must disagree with this assumption.

Typical errors . . . As a matter of comparison as to the size of error involved in this basic assumption, a review of the dolomite reef at LeDuc is of interest. Extensive laboratory analysis was conducted on sections of LeDuc cores to determine porosity. Results showed that porosity actually totaled 9.02 per cent and was distributed as follows: crevices 0.26 per cent; vugs 5.11 per cent; intergranular 0.72 per cent; dense 2.92 per cent.

Normal core-analysis procedures from the same sections gave porosity to be only 6.8 per cent, or 2.22 per cent less than actual. By use of the common volumetric calculation method at LeDuc, the error in oil in place would be 32 per cent. This size error in oil

TABLE 2—WEST TEXAS REEF "A"—VOLUMETRIC RESERVES BY NET ANALYSIS

Wells analyzed by cores—	Gross feet cored	Net footage cored—all above 3 per cent porosity	Net section total porosity (ft.)
Operator A:			
Well 3	142	100	803.21
Well 24	55	54	502.10
Well 2	87	81	790.94
Well 23	15	6	36.40
Well 12	17	13	100.32
Well 5	178	148	1,051.67
Subtotal	494	402	3,284.64

Wells analyzed by neutron interpretation—	Gross feet analyzed	Net feet—all above 3 per cent porosity	Net section total porosity (ft.)
Operator B:			
Well 1	91	83	799.4
Well 2	39	34	364.8
Well 3	14	14	245.0
Well 4	17	17	278.8
Well 5	30	30	510.0
Well 6	10	10	60.0
Subtotal	201	188	2,258.0
Grand total	695	590	5,542.64

Recovery calculations:	
Per cent net of gross (590 ÷ 695)	84.9
Average net porosity	9.4
Average net connate water (36.4) (.849)	30.9
Oil originally in place per net acre-foot: 7,758 (.094) (.691) ÷ 1.524	331
Total net acre-feet (493,372) (.849)	418,873
Total oil originally in place (418,873) (331)	138,646,963
Recovery factor, per cent	45
Originally recoverable oil, bbl.	62,391,133

THE AUTHOR

Richard W. Hillyer is vice president and Houston division manager of the geological and engineering consulting firm, Ralph H. Cummins Co. After graduation from University of Oklahoma in 1947, he joined Carter Oil Co. where he served until 1952 in various technical and executive capacities in Illinois, Oklahoma, and Louisiana. He is a member of A.I.M.E. and A.P.I., is a registered professional engineer in Louisiana and Texas, and is chairman of Gulf Coast Committee of Production Statistics, A.I.M.E.

in place would lend credence to the belief of resulting error in calculation of recoverable oil.

It is proposed therefore that our calculations in future be done by a method which admittedly does not alleviate the problem of inadequate data, but which does eliminate a number of assumptions now made.

New Calculation Procedure

The procedure advocated is essentially quite simple. It consists of varying one step in the usual method. This step is the calculation of a "net-to-gross" percentage. Instead of selecting an arbitrary point of delineation between pay and nonpay, let's total all porosity, permeability, and connate-water values and obtain a gross average for each. The remaining steps in the analysis are the same as before.

Usually, both of these methods will give approximately the same results. As an illustration of this, the accompanying Tables 1 and 2 have been prepared, with the name of the actual reef analyzed deleted. It will be noted that the gross method shown in Table 1 gives 132,717,069 stock-tank barrels in place as compared to 138,646,963 resulting from the net calculation.

The gross method is at least as accurate as the net method and probably more so, since it has similar weaknesses in basic data, but eliminates the necessity for additional assumptions. Possibility for error is involved in every assumption made which is not required.

Net method assumptions . . . The net method first assumes that the core data available are sufficient to calculate an accurate "per cent net of gross." As a refutation of this, in one reef studied recently, the core-analysis data from 494 ft. of samples and the neutron-log characteristics for 201 ft. of formation were analyzed for a total of 695 ft.

Since this 695 ft. analyzed represented only approximately 10 per cent of the total footage drilled, the calculation of a "per cent net of gross" from this small a percentage of the reef is subject to some hazard—particularly where it is considered that there was structural repetition in sections cored and analyzed in various wells.

Secondly, the net method assumes the accuracy of an arbitrary decision made by the analyst as to what constitutes net pay. As an example of the variation possible here, in the studies of the Kelly-Snyder reef of Scurry County, the SACROC committee selected 3 per cent porosity as the dividing point between pay and nonpay, the Bureau of Economic Geology of University of Texas selected 4½ per cent porosity, and the U. S. Geologic Survey selected 4 per cent porosity. The U. S. Bureau of Mines used a different criterion entirely, selecting as productive everything having over 0.1 md. permeability.

As could be expected, these variations in definition of net pay resulted in variation in per cent net of gross of from 56.45 per cent to 70.2 per cent. This wide latitude in estimates made by competent authorities illustrates the inherent weakness of a system which so largely depends on judgment of the analyst.

More work needed . . . Clearly, the procedure advocated here is not the final answer. It is merely an attempt to remove some degree of error from the method currently in use. The true answer to this problem in reefs, as well as other carbonate reservoirs, lies in continued research, both geologic and engineering. It is strongly urged, however, that the proposed method be carefully weighed and eventually accepted in order that we will all at least start from the same point.

Fracturing May Get Assist by Removing Reservoir Salt

A REASON for good completion results in the use of fresh water and sand in fracturing ("Riverfrac") may be due to the removal of salt from the reservoir rock.

The use of fresh water as a formation fracturing fluid was begun several months ago in the gas fields of the San Juan basin of New Mexico and Colorado. Due to scarcity of viscous fracturing oils in this relatively remote area, gas-well operators and service companies began to experiment with fresh water as a substitute. The treatments, successful from the start, were immediately named "Riverfrac" because the San Juan River was the source of much of the water used in the process.

Later, oil-well operators in the Permian basin began to use the method. Here, too, unexpected results were obtained. One well which had produced no oil for many months was gaged at more than 90 bbl. daily after a Riverfrac treatment of 30,000 gal.

One of the pieces in the puzzle was found by Dowell Incorporated engineers, in analyzing the well following Riverfrac. The fresh water injected into the well always returned to the surface containing salt in solution; often the returned water was saturated. Another clue was found in the oil produced from the wells.

Analyses of many oils show that they contain salt in varying amounts—from 2.1 lb. per thousand barrels for the Spraberry to as much as 490 lb. per 1,000 bbl. for the San Andres formation. An idea of the amount of salt that can be removed from a well by the Riverfrac process is shown by one West Texas well treated with 30,000 gal. of fresh water and 30,000 lb. of sand. An analysis of the total volume of water pumped from this well showed it contained 54,000 lb. of salt.

Tests made on the effect of the fresh water on the producing formation have been favorable. It is believed that if the casing is set through the pay section and perforated opposite the pay zones, no harmful sloughing or undue swelling of the various formations will occur.

If the Riverfrac results are proved to be caused by a combination of formation fracturing and salt removal, it may be possible to forecast with some degree of accuracy the results to be obtained with Riverfrac on new wells by performing a salt analysis of the crude oil. On older wells forecasting may be difficult because information may not be readily available on the amount of salt produced from the well.

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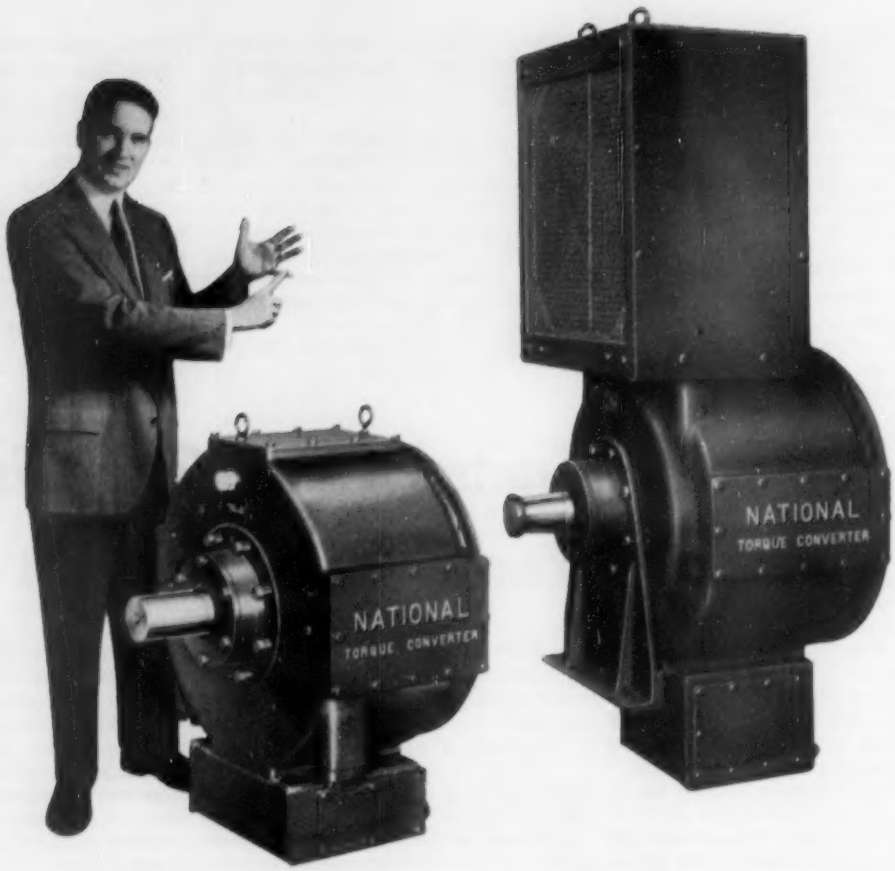

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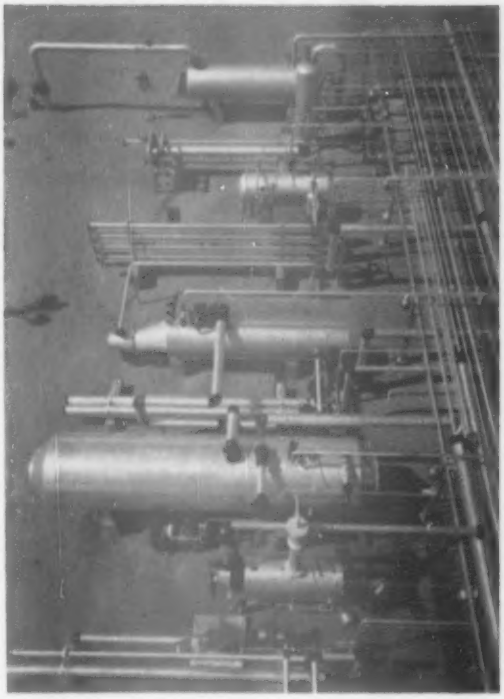
Modern Safety System in West Texas Midget Plant

by F. H. Lacy, Jr., and G. B. Evans

Part 4

PORTABLE GASOLINE-PLANT SYMPOSIUM



OVERHEAD VIEW of horizontal process vessels. From top to bottom: inlet scrubber, refrigerant accumulator, chiller, raw product tank, and glycol regenerator.

IN addition to the usual plant safety devices, an extensive alarm and shutdown system has been provided. This system warns of unusual changes in plant operation by sounding an alarm in the plant and in the resident operator's home. It also indicates by lights on a panel the location of any unusual changes. In addition, the system shuts down the plant and holds it safe until readjusted and restarted if the unusual change increases and whenever such action is necessary to protect plant equipment or personnel.

The alarm panel has its electrical components so arranged that only the original source of trouble can sound an alarm and turn on a light —unless the reset button on the alarm panel is pressed. When the reset button is pressed any other alarm device which has been actuated also turns on a light. This enables the operator to distinguish between the condition causing the original alarm and any other subsequent happening which may require attention.

The shutdown mechanism is extremely simple. For reliability, it is separated electrically from the alarm system and is battery powered. It works by:

1. Grounding the compressor-engine magneto.

2. Actuating a three-way valve which closes off the gas used in the instrument pneumatic system and vents to atmosphere any instrument gas in the instrument system. This causes all motor valves to fail in a safe position, including a motor valve which shuts off fuel gas to the compressor engine. This particular motor valve requires manual resetting so that the instrument system can be put back into operation without fuel-gas pressure existing on the compressor engine until such time as the operator is ready to restart the engine.

Authors are with Honolulu Oil Corp. Paper presented at the thirty-fifth annual convention, N.G.A.A., Fort Worth, April 11-13, 1956.

The various shutdown and alarm points are listed below and are shown on the flow diagram (Installment 2, June 11, 1956).

Shutdown and Alarm Points

Compressor engine:

High jacket-water temperature.

Engine overspeed.

Low lube-oil pressure.

There is only one light on the alarm panel for all of these devices.

Level:

Inlet scrubber, high level.

Second-stage suction scrubber, high level.

Third-stage suction scrubber, high level.

Chiller, high level.

Raw-product surge tank, high level.

Fuel-gas scrubber, high level.

Refrigerant accumulator, high level.

Para-Cyment heater (vaporizer), low level.

Pressure:

Third-stage discharge, high pressure.

Refrigerant discharge, high pressure.

Para-Cyment heater (vaporizer), high pressure.

Alarm Only Points

Level:

Raw-product surge tank, high and low level.

Refrigerant accumulator, high and low level.

Pressure:

Deethanizer, high pressure.

Depropanizer, high pressure.

In addition to the above points, a manual emergency-shutdown button is provided on the alarm-system panel located adjacent to the plant near the plant gate.

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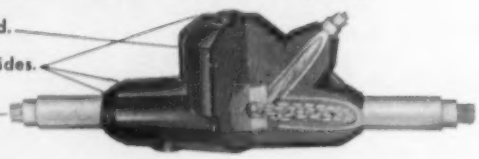
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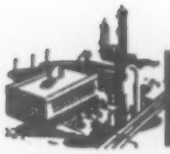

How Crude Oil Becomes Usable by Distillation—1

CRUDE oil as it comes from wells can rarely be used except for fuel purposes. The value of crude lies in the many products which may be processed from it in the modern refinery. The recovery of desired products is made possible by an operation which is known as distillation.

Crude oil is a mixture of many hydrocarbons of varying types, molecular weights, and boiling points. To separate the crude oil into pure hydrocarbons is impractical. The need of the consumer of petroleum products is not for entirely pure chemical components, but for fractions of the oil which have a rather wide boiling range.

For the most part, crude oil is refined to make the following products:

Gas (for fuel purposes), gasoline, kerosine, naphtha, furnace oils, lubrication stocks, and fuel oil.

Each of these products is a mixture containing many pure hydrocarbons. To achieve maximum recovery of the desired products requires some understanding of the principles of vaporization and condensation.

Principles of Distillation

The fact that liquids can be physically changed from liquid into vapor (vaporization) and back into liquid (condensation) is the basis of several very important industrial processes. One of these processes which is widely used in petroleum refining is the separation of liquids by distillation.

Distillation is the separation of the components of a liquid mixture by the partial vaporization of the mixture and separate recovery of the vapor and residue. The process is accomplished by vaporizing or boiling away the low-boiling-point liquid and leaving behind the high-boiling-point liquid.

This material is taken from "Fundamentas of Refining," operating manual of Magnolia Petroleum Co., refining division, Beaumont, Tex.

There are several requirements that must be met before separation by distillation can be completed.

It is well known that heat must be supplied to make water boil. After the water starts to boil, further heating does not cause the water to get hotter, but merely keeps it boiling away or vaporizing. If the source of heat is removed, the water immediately stops boiling. The removal of the steam coil from the water pot used to boil water for making coffee on the units illustrates this fact.

This demonstrates that heat is required to change liquid into vapor. It points to one of the requirements for distillation—a source of heat to vaporize a portion of the liquid to be separated. The heat required to cause vaporization is called "latent" because its effect is not shown by a temperature rise in the liquid. The latent heats of vaporization for various liquids are different.

Condensing . . . Some means must be had for recovering the portion of the liquid which has been vaporized. This is done by condensers. Condensers are cool surfaces which remove the latent heat of vaporization from the vapor and cause it to change back to a liquid.

Each different liquid has its own boiling temperature. From the definition of distillation, it would seem that all that is required to effect a separation of a liquid would be to heat the mixture to the boiling point of each liquid, starting with the lightest, and condense each vapor separately. This is not the case. To show why this is not true, take as an example a pan of water exposed to the air. The water will gradually disappear (vaporize) from the pan although the water is well below its boiling point. From this it can be seen that liquids have a tendency to vaporize at temperatures below their boiling points. Whenever there is space above a liquid, some of it vaporizes until its vapor reaches a definite pressure against the surface of the liquid and walls of the vessel or atmosphere above it.

The pressure at which this vaporization stops is known as the vapor pressure of the liquid. Every liquid has its own definite vapor pressure and it varies according to the temperature of the liquid. The presence of another component (liquid or vapor) which is insoluble in the liquid does not change this vapor-pressure effect.

To illustrate, the water vapor over pure water at 212° F. in a closed vessel exerts a pressure of 14.7 psi. against the surrounding surfaces. This same pressure will be exerted even if the vapor space contained air at 50 psi., thus making the total pressure equal to 64.7 psi. This demonstrates that the vapor pressure of a liquid depends only upon the temperature of the liquid.

The effect of temperature upon a liquid vapor pressure is very noticeable because a higher temperature causes high vapor pressures. A liquid surrounded by a pressure which is lower than its vapor pressure will partially vaporize. This change must be accompanied by the absorption of the latent heat of vaporization. If the heat is not supplied externally, it will be obtained from heat possessed by the liquid with a reduction in liquid temperature. The change in liquid temperature will effect a reduction in the liquid's vapor pressure. Finally, a temperature will be reached where the vapor pressure will be equal to the surrounding pressure and vaporization will cease.

When attempts are made to boil off a light liquid from a heavy liquid, some of the heavy liquid also vaporizes. The closer the boiling points are together, the larger the amount of heavy liquid that will vaporize. In every case, however, the vapor obtained by partial vaporization always will be richer in the light component. This is one of the important properties of liquids that permits their separation by fractional distillation.

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BETHLEHEM STEEL

by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Capacity of Crude-Oil Bubble Towers

In your answer of October 31, 1955, regarding a quick estimate of topping-tower capacity, the capacities found by your formula seem to be low. Can you explore this for us?—P.R.

The formula given in the October 31, 1955, issue applies only to topping towers, that is, the fractionation of crude oil at substantially atmospheric pressure and producing at least kerosine and gas oil as side products. In addition, quick formulas are for the judging of equipment, construction and design of which are not fully known, and accordingly, they must be very conservative. Thus many well-designed modern towers can handle nearly twice as much as the formula indicates.

In addition to topping towers, so-called crude flash towers which produce primarily a top product and what might be called pressure towers, are also used to distill crude oil. The capacity of towers used in these ways is far greater than the capacity of a topping tower.

Fig. 1 indicates some of the many ways that a 9-ft.-diameter tower can be used in reducing 38.6° A.P.I. Mid-Continent crude to a 32.5 per cent residue. The capacities range from 9,500 to 40,000 bbl. per day when modern towers are loaded to maximum capacity. Many older towers cannot handle such capacities, being limited to 60-65 per cent of such capacities. The formula referred to in the equation indicates a capacity of only:

$$9^2 \times 2.25 \times 32.5 = 5{,}900 \text{ bbl. per day}$$

This corresponds to a 24-in. spacing in the arrangement No. 9 in Fig. 1.

Even larger capacities might be attained by the use of mist extractors below each product plate and the use of fewer trays.

Economics of Refinery Operation

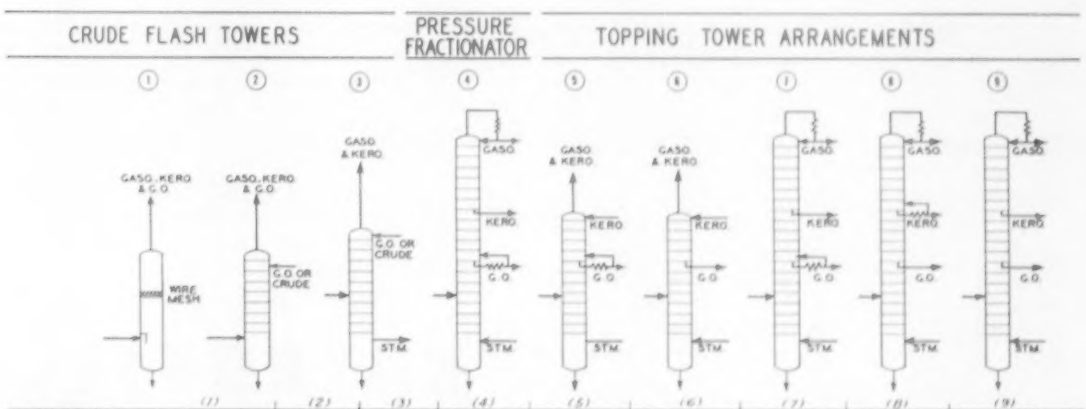
Can you direct us, please, to books on the economics of refinery processing? We have not been able to find ones that are practical. P.S.G.

The extreme complexity of the petroleum refining industry makes it almost impossible to prepare a book on the subject unless, of course, only rudiments are included. Refinery economics become exceedingly complicated because of all of the technical details of refinery processing, costs of transportation, operation, etc., and an almost endless variety of crude oils and of products as well as numerous alternate methods of processing. However, an excellent practical book which treats some phases of refinery economics along with the problems of the entire industry is "The Growth of Integrated Oil Companies," by McLean and Haigh (Graduate School of Business Administration, Harvard, 1954). A few of the topics that are discussed (usually in connection with general studies) are:

1. Advantages of small and of large refiners.
2. Special fields of small refiners.
3. Profitability of operations at reduced capacity.
4. Effect of capacity on profitability.
5. Manpower requirements.
6. Investment for various types of refineries.
7. Yields of products for the same variety of refineries.
8. Operating costs of the same variety of refineries.
9. Optimum investment between capacity, storage, and tanker transport.
10. Crude-oil realizations.
11. Transportation costs.
12. Pipeline construction costs and tariffs.
13. Cost indexes, construction and operation.

From even this short list of topics it is evident that current magazine articles must constitute the main source of economic information, rather than books, because of the extremely detailed nature of the subject.

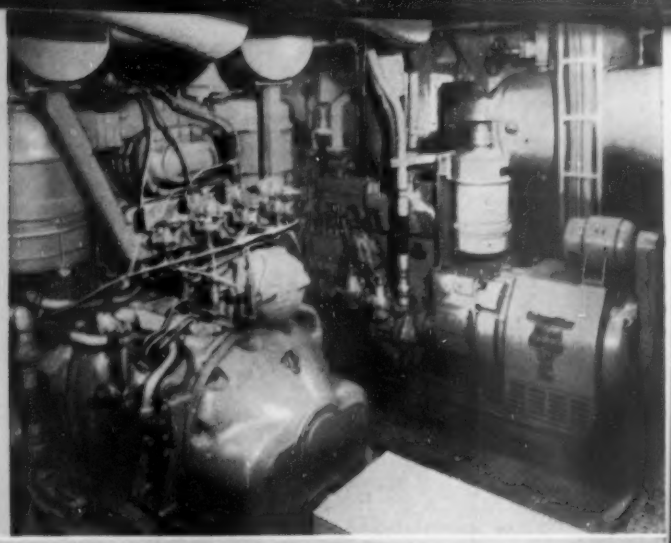
A discussion of refinery accounting with some references, was published in the April 5, 1951, (p. 100) issue of this page.

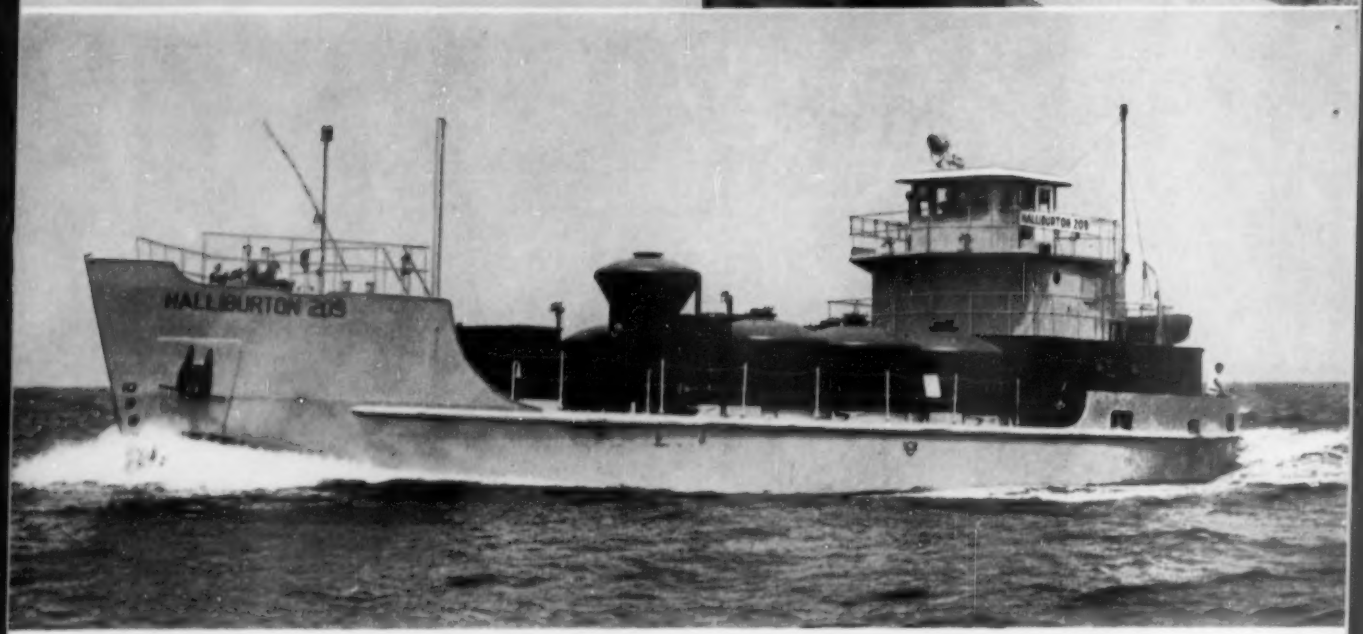


	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CAPACITY, B.P.D.	40,000	32,500	28,000	18,600	13,300	13,300	10,700	18,000	14,400	13,100	10,800	12,700	10,200	12,700	10,200	12,700	10,200	11,900	9,500
TRAY SPACING	–	36-18	24	36	24	36	24	36	24	36	24	36	24	36	24	36	24	36	24
PRESSURE, PSIG	50	50	50	2	2	2	2	50	50	3	3	3	3	4	4	4	4	4	4
STEAM	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Fig. 1—Approximate capacity of 9-ft.-diameter towers in reducing 38.6° A.P.I. crude oil to a 32.5 per cent residue.

FOR PROPULSION AND AUXILIARY POWER "HALLIBURTON 209" RELIES ON CAT* ENGINES





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MODERN HEAVY-DUTY DIESEL ENGINES

by W. L. Nelson
Technical Editor

COST-imating

Can Inflation in Construction Costs Be Halted?

DURING the period 1932-1946, refinery construction costs increased at an average rate of 4-4½ per cent per year. Since 1946, the average rate of increase has been nearly 10 per cent per year and with another large hike in steel prices, the increase during 1956 should be equal or larger. Inflation is cheerful because it pays for an investment as well as its depreciation, if only the interest on the investment is kept up. However, are the funds that would be needed for replacement and obsolescence being laid aside for the time when inflation halts? If not, then we can only contemplate more inflation and in time interest rates of 10-15 per cent as in Brazil and elsewhere. How long will investors be content to have only half of their money (in terms of purchasing power) returned to them?

The cost indexes on this page may be used to convert prices known at any date to prices at other dates or the present, by ratios of the cost indexes of the same dates. Similar Itemized Cost Indexes are published quarterly in the first weekly issues of January, April, July, and October. In addition, the Nelson Refinery Construction Cost Index is published in the first issue each month of The Oil and Gas Journal in Engineering Section.

Itemized Cost Indexes

(Multiply the 1946 prices of the Cost-imating Series by these Index Numbers divided by 100.)

	1948	1950	1952	1954	1955	Feb. 1956	References*	Index for earlier years (The Oil and Gas Journal) in Cost-imating issues
Labor:								
Skilled construction	125.0	140.0	157.9	174.6	179.8	183.8	Eng. News Record	No. 55—Nov. 3, 1949
Common labor	131.0	148.1	168.2	192.1	199.4	204.9	Eng. News Record	No. 55—Nov. 3, 1949
Refinery construction	128.0	144.0	163.1	183.3	189.6	194.4		No. 61—Dec. 15, 1949
Refinery operation	126.0	137.6	155.1	169.5	176.7	184.0	Sur. of Current Business	No. 55—Nov. 3, 1949
Equipment or materials:*								
Arc-welding machinery			151.3	158.4	163.8	166.5	Code ‡11-76	May 2, 1955§
Boilers, tanks, and sheet metal	†140.0	†136.0	†153.4	147.3	150.3	158.3	Code 10-72	April 21, 1952§
Boiler tubes, 2-2¼ in.	131.3	149.5	168.8	199.4	211.2	219.7	Code 10-14-61	Sept. 5, 1955§
Building materials (nonmetallic)	120.6	127.6	134.8	143.6	149.4	151.0	Code ‡13	No. 22—Mar. 17, 1949
Brick—building	122.8	132.5	140.6	144.7	150.5	156.9	Code 13-41	No. 20—Mar. 3, 1949
Brick—fireclay	133.3	153.4	167.1	193.1	205.9	213.1	Code 13-42	May 30, 1955§
Castings (foundry products)	144.6	152.9	168.0	181.1	185.1	196.6	Code 10-15	No. 46—Sept. 1, 1949
Clay products (structural, etc.)	121.3	134.6	145.8	159.1	167.4	174.0	Code 13-4	No. 20—Mar. 3, 1949
Concrete—ingredients	119.4	125.3	132.7	142.1	146.6	152.5	Code 13-2	No. 22—Mar. 17, 1949
Concrete—products	118.9	124.4	132.6	138.5	139.8	142.8	Code 13-3	
Electrical machinery	127.6	134.9	152.4	159.9	162.5	168.8	Code ‡11-7	May 2, 1955§
Electrical motors and generators	128.6	135.0	154.6	157.7	157.1	162.3	Code ‡11-73	No. 31—May 19, 1949
Electrical switchgear			161.4	171.2	176.5	187.3	Code ‡11-75	May 2, 1955§
Electrical transformers, etc.	127.0	131.6	148.0	161.9	161.8	168.2	Code ‡11-74	No. 31—May 19, 1949
Engines (composite)	116.9	126.0	146.5	150.5	153.2	160.6	Code ‡11-54	No. 36—June 23, 1949
Exchangers	130.0	140.0	165.8	174.5	156.8	188.0	Manufacturer	No. 2—Oct. 28, 1948
Fans and blowers	131.3	162.9	183.7	192.6	199.7	210.9	Code 11-47	Feb. 17, 1949§
Hand tools	125.2	143.2	155.1	173.8	185.7	195.1	Code 10-42	June 27, 1955§
Instruments (composite)	120.0	127.8	146.2	154.6	162.9	180.3	Manufacturer	No. 34—June 9, 1949
Flow meter (mechanical)	....	114.0	132.3	161.6	177.2	203.3	Manufacturer	No. 34—June 9, 1949
Flow meter (air control)	....	138.5	160.5	179.6	188.6	203.1	Manufacturer	No. 34—June 9, 1949
Flow meter (remote)	....	135.5	155.3	146.5	153.5	170.2	Manufacturer	No. 34—June 9, 1949
Potentiometer, 6-point	....	134.0	151.5	167.2	178.6	208.3	Manufacturer	No. 34—June 9, 1949
Potentiometer, air control	....	134.1	144.9	150.2	164.0	190.2	Manufacturer	No. 34—June 9, 1949
Pressure controller recorder	....	135.6	158.4	166.3	169.1	187.1	Manufacturer	No. 34—June 9, 1949
Pressure gage	....	101.2	108.6	108.6	112.1	119.2	Manufacturer	No. 34—June 9, 1949
Thermometer (recording)	....	124.0	149.4	152.8	156.5	170.2	Manufacturer	No. 34—June 9, 1949
Control valve	....	133.3	155.5	162.0	166.8	171.5	Manufacturer	No. 34—June 9, 1949
Insulation materials	126.8	125.0	130.4	135.5	131.8	130.4	Code 13-72	
Lumber (composite)	181.0	193.0	203.2	197.8	209.7	216.1	Code 8-1	No. 7—Dec. 2, 1949
Lumber (Southern Pine)	174.3	176.9	191.2	181.2	188.4	192.3	Code 8-12	No. 7—Dec. 2, 1949
Lumber (other soft woods)	206.5	230.2	248.5	252.7	265.1	269.8	Code 8-13	
Machinery—general purposes	124.9	136.7	151.8	159.9	166.8	176.7	Code 11-4	Feb. 17, 1949§
Machinery—construction	127.8	140.1	157.5	165.9	172.5	181.0	Code 11-2	
Machinery—oil field	†125.9	†135.8	†149.9	†161.9	†168.5	†175.9	Code 11-51	Oct. 10, 1955§
Paints—prepared	141.4	140.0	155.7	159.0	161.4	167.9	Code 6-21	May 16, 1955§
Pipe, sewer	110.9	120.7	136.9	140.1	149.9	158.2	Code 13-45	No. 22—Mar. 17, 1949
Pipe, black iron	141.0	160.0	179.0	195.0	204.0	225.5	Code 10-14-56	
Pumps, air compressors, etc.	127.0	138.2	155.6	166.5	177.2	181.4	Code 11-41	No. 29—May 5, 1949
Steel (iron and steel)	141.1	152.9	168.5	179.6	189.9	201.4	Code 10-1	No. 61—Dec. 15, 1949
Steel—finished steel	135.7	153.7	170.0	187.1	196.0	205.8	Code 10-14	July 25, 1955§
Steel—plate and sheet		(See boilers, tanks, etc., above)						
Steel—structural shapes	145.0	162.7	176.2	193.4	204.3	211.8	Code ‡10-14-31	No. 18—Feb. 17, 1949
Valves and fittings	†125.9	†135.8	190.8	197.1	208.6	223.5	Code ‡11-49 (1-6 & 11-14)	No. 46—Sept. 1, 1949
Nelson Refinery Construction	132.5	146.2	163.6	179.8	184.2	191.1		No. 61—Dec. 15, 1949

*Code refers to the revised index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices." †Estimated base value for 1946. ‡Not exactly the same items as those published before July 7, 1952. §Questions on Technology, The Oil and Gas Journal.

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PAINTING STEEL—1

Correct Painting Methods Pay Dividends

by J. O. Jackson* and Joseph Bigos†

PETROLEUM refineries can save large sums of money each year through the proper painting of steel. The most important factors in gaining good service from paint systems are:

- Proper design.
- Surface preparation.
- Correct application, selection.
- Good formulation of paints.

Structural steel in a refinery can be grouped into four categories: storage tanks, process units, yard piping, and buildings. Painting the roof and shell of volatile-product storage tanks white is recommended when product savings compensate for shortened paint life.

The paint protection necessary for process units is determined by severity of environment. Painting of yard piping is not always economically justifiable and consideration should be given to: (1) cost of the protecting system; (2) safety markings; and (3) color identification.

Building interiors, usually noncorrosive, are protected easily and color conditioned at no extra cost to give good appearance and light reflectivity.

Economics . . . Organic coatings or paints have a relatively low initial capitalized cost. Furthermore, maintenance painting costs — which are generally low — are chargeable to operating costs. Although painting costs are low, compared to the use of metallic coatings or stainless alloys, these costs may still be too high for the corrosion protection they afford. A careful analysis should be made to determine if protection is necessary and economical.

An increased corrosion allowance in the original thickness of steel might be adequate and economical. Harvey[1] calculated the economics of painting vs. increasing thickness of steel and concluded that for industrial atmospheres it is cheaper not to paint—if protection only is considered. (He concludes that painting is worth while if the value of the decorative aspects of painting are included.)

Consider the economical facts of painting vs. a corrosion allowance:

1. In 20 years mild steel in an industrial atmosphere will lose 20-mil thickness by over-all rusting.

2. Because pitting does occur, a rate of 2 to 1 is allowed by Harvey, but 4 to 1 would be more logical for structural steel.

3. A corrosion allowance of 40-mil thickness of steel per surface exposed will be used.

4. If only one side is exposed, 1.6 lb. of steel per square foot must be added.

5. At 50 cents per pound of steel, additional investment of 80 cents per square foot must be added to allow for corrosion.

6. Harvey estimates the cost of original painting is 50 cents per square foot (10 cents for sandblasting, 8 cents for materials for four coats, and 32 cents for applying the four coats). Touch-up painting he estimates to cost 5 cents per square foot, and complete repainting will be necessary—at the same cost as the original painting—every 5 years. In 20 years the total paint cost will be $3 per square foot. Therefore, he concludes it is cheaper to increase thickness of steel rather than to paint. The previous figures for painting costs are felt to be completely out of line with reality for an industrial atmosphere, although they may be correct for a very corrosive chemical environment. Therefore, the published cost data of Radecke[2] and of the Steel Structures Painting Council (S.S.P.C.)[3] will be used. We will consider the painting of oil-storage tanks at a refinery yard in an industrial atmosphere as an example.

7. Radecke shows that a typical tank can be painted for 12.2 cents per square foot — sandblasting and applying four coats of paint. Adding a generous allowance for overhead costs, this figure becomes 16 cents per square foot. The life of the paint job is 7 years. Repainting—spot clean, spot prime, and two finish coats—cost 6 cents per square foot, or 8 cents per square foot, allowing for overhead. The life expectancy is the same as the new job. Total painting cost for 20 years is 32 cents per square foot.

8. S.S.P.C. data and cost methods estimate the cost of the original painting to be 24 cents per square foot if done by contract. Life expectancy is again 7 years. Repainting by contract will cost 10 cents per square foot. Total painting cost for 20 years will be 44 cents per square foot.

9. Without allowing for capitalization costs, lost profit because of increased investment, etc., the situation is as follows:

FOR A 20-YEAR PERIOD

If steel costs (cents per lb.)	—Cents per sq. ft.— Increasing steel thickness cost	Painting costs
50	80	32 to 44
40	64	32 to 44
30	48	32 to 44
25	40	32 to 44
20	32	32 to 44
15	24	32 to 44
10	16	32 to 44

It is apparent that for fabricated and erected steel which costs as much as 20 to 25 cents per pound, it is about as cheap to paint as to add a corrosion allowance.

*Vice president in charge of engineering and research, Pittsburgh-Des Moines Steel Co., Pittsburgh. †Senior fellow, Mellon Institute of Industrial Research: Director of research, Steel Structures Painting Council, Pittsburgh. Paper presented at A.P.I. Refining Division meeting, Montreal, May 14, under the original title, "Painting of Steel Structures in Petroleum Refineries."

References

1. Harvey, C. C., "Economic Factors of Atmospheric Corrosion Vs. Protection," Proc. A.P.I. 33 (3) 268 (1953).

2. Radecke, F. T., "Selection of Paints and Application in Combating Atmospheric Corrosion," Proc. A.P.I. 34 (3) 37 (1954).

3. Bigos, Joseph, editor, Vol. 1, "Good Painting Practice" and Vol. 2, "Systems and Specifications," Steel Structures Painting Manual (1954-55).

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Drilling Contractors

Gene Reid Drilling Co., Inc., is contractor for Humble Oil & Refining Co.'s new Semitropic wildcat about 1 mile southwest of Wasco oil field, the 1 Elizabeth G. Williams et al in 24-27-23, California. The well will go to 8,000 ft. The test is located several miles southeast of Semitropic gas field.

Hoover Drilling Co., Bakersfield, has contract for a new wildcat test to be put down in Midway-Sunset field, 1-32-22, California. Oceanic Oil Co.'s L-1-1 will try for production in the Republic sand at 5,000-6,000 ft. The well is 1,850 ft. northeast of Oceanic's "B" pool.

Camrich Drilling Co. is contractor for MJM&M Oil Co.'s stepout test in the Cat Canyon sector of the California coast. The Cal Trust No. 15 well will go down in 14-9n-33w. Drill-site is 2,000 ft. north of production. MJM&M has four oil wells producing at Cat Canyon, including one in the Schist and three in the Thomas sand.

Penrod Drilling Co. has contract for Placid Oil Co. and J. Ray McDermott's 15,000-ft. wildcat in Lafourche Parish, South Louisiana, 3 miles west of Patterson field. The 1 Shadeyside Plantation is in 2-15s-11e, 3½ miles north of Bartel Townsite.

W. C. Fatjo, Inc., is contractor for Sunray Mid-Continent Oil Co. 1 A. C. Chappuis in 3-7s-12w, Shoats Creek area, Beauregard Parish, South Louisiana. The well is a 9,000-ft. try.

O. H. Parker 1 Brite on the J. K. Brite 189-acre tract, northeast corner of Josepha Diaz Survey, Montague County, Texas, will be drilled by **Collum Drilling Co.,** Wichita Falls contractor. The 7,200-acre test is a 40-acre offset to a Viola well that has been flowing for the past 2 years.

Trans-Era Petroleum, Inc., has recently changed its company name to Sierra Petroleum Co., Inc., according to Robert F. White, president. The Wichita firm operates seven rotary rigs in Kansas and the Denver - Julesburg basin area, partially on a contract basis and partially on Sierra exploration supervised from the company's home office at 420 West Douglas Street. Field operations are out of Russell and Kimball.

Dan Clark Drilling Co. has contract for Parker Petroleum 1 Lawhon, a 8,600-ft. test in San Patricio County, South Texas. The well will test through the Frio section. Location is 1 mile east of Odem pool.

Webster Drilling Co. is contractor for Parker Petroleum Co., Inc., 1 Paul Hayes, C NW 18-4n-23eCM, a Morrow and Mississippian-Chester wildcat to be drilled to 6,800 ft. in Beaver

On the floor of a deep-drilling rig Robinson Brothers Drilling Co., Borger and Midland, Tex., has under contract to Haskins & Knickerbocker on a deep wildcat test 10 miles northeast of Caprock, in northwestern Lea County, southeastern New Mexico. Left to right: Joe Shirley, superintendent Berry Ellige, tool pusher; Fred Landis, driller; Don Williams, floorman; H. O. Beasley, motorman;; E. L. Samuels, derrick man; and A. L. Cockran, floorman.

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County, Oklahoma Panhandle. The well is 5 miles south and 4 miles west of Forgan pool, 2 miles southwest of the West Beaver-Panhandle area, and 15 miles north of Elmwood field where Webster drilled six other wells for Parker.

Makin Drilling Co. has contract for a 10,000-ft. wildcat in Lea County, New Mexico. The Southeast New Mexico wildcat will be drilled for Aztec Oil & Gas Co. and Delhi-Taylor Oil Corp. It will be known as the 1 State "LW," 2-10-33.

J. C. Crain Drilling Co. has contract for a well in Dollarhide-Fusselman field, Lea County, Southeast New Mexico, for Skelly Oil Co. The new try is in 32-24-38, and is called the 24 New Mexico "J."

Dixilyn Drilling Co. has contract for Gulf Refining Co.'s proposed Rodessa test in Pistol Ridge field, Pearl River County, Mississippi. The deep 12,500-ft. test is in 3-1s-14w. It will be known as the 1 Coryell McKinney. Location is about ½ mile south of Lower Cretaceous oil production in Pistol Ridge field, and 2¼ miles east of a currently testing Lower Cretaceous discovery.

Rocky Mountain Drilling Co., Los Angeles, has the contract on another deep test Western Gulf Oil Co. is undertaking in the Fruitvale area, west of Bakersfield, in Kern County, California. The test, 1 Shellbarger-Selden, in 30-29-27, is about 1¾ miles west of production. Its objective, the Vedder sand, is expected about 10,350 ft. Location is about 3 miles northwest of a 11,577-ft. dry hole drilled by Western Gulf earlier this year.

Miller & York, Bakersfield, Calif., are drilling on a projected 9,000-ft. wildcat test in the Five Points area, Fresno County, Central California. It is a contract job for Geochemical Surveys. Location is at 72-18 Mahoney, in 18-17-17.

San Joaquin Drilling Co., Los Angeles, is contractor on a deep exploratory test Universal Consolidated Oil Co. is starting in an old relatively shallow producing area at Lost Hills, in northwestern Kern County, California. It will be Universal's 265 fee, in 32-26s-21e. Hole is scheduled to be carried to 10,000 ft.

A. W. Thompson Drilling Co., Houston, is drilling for Jake L. Hamon at wildcat location 10 miles east of Caprock, in northwestern Lea County, New Mexico. It is a 12,600-ft. Devonian test on a state lease in 35-10-33.

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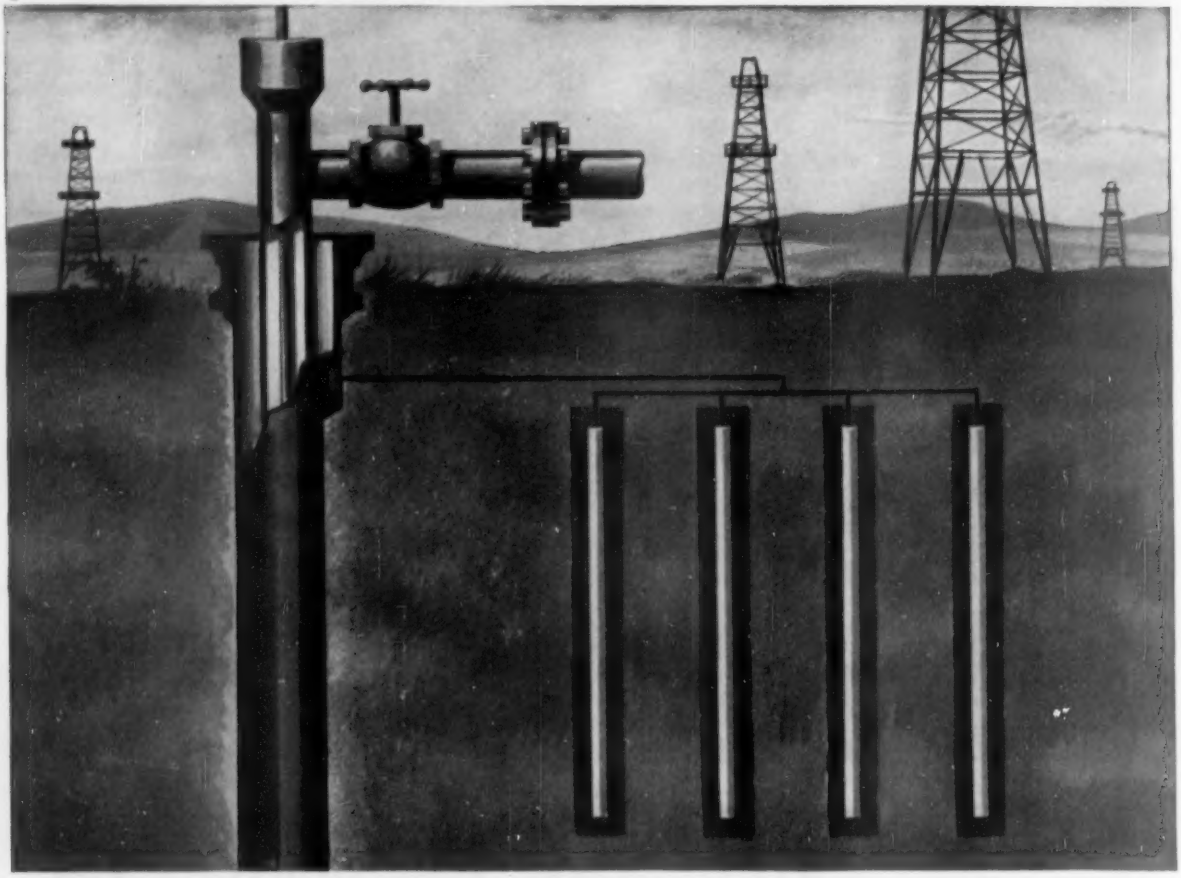

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How to Make Pipeline-Flow-Efficiency Tests

Attention to details will give you good test results. Ammonia-displacement method comes in for high praise at Texas A. & I. College discussion.

by Larry Resen
District District

TEXAS A. & I. COLLEGE PANEL MEMBERS included: R. F. Bukacek, Institute of Gas Technology; Earl Humble, Texas Eastern Transmission Corp.; Jack N. White, Panhandle Eastern Pipe Line Co.; J. M. Phillips, Southern Natural Gas Co.; and Sy Orlofsky, Gulf Interstate Gas Co., moderator.

WHAT is the best method to follow in making pipeline-flow-efficiency tests? What precautions have to be taken? What can you do with the results?

These were some of the questions discussed at the eleventh annual Short Course in Gas Technology held recently at Texas A. & I. College at Kingsville.

On the surface, flow efficiency is a simple matter. Find out the actual flow, determine the theoretical flow, and with a quick bit of arithmetic you have your answer. However, determining actual flow in a gas-transmission line is a tricky job, so is the theoretical flow calculation. The line goes up and down bringing an elevation correction into the problem. Temperature of the gas changes and necessitates compensation, pressure measurements are tricky, and establishment of a stable flow, during the test runs, calls for special precautions.

Industrial panel members discussed the subject in a special session at the short course. Sitting on the panel were: Jack N. White, Panhandle Eastern Pipe Line Co., Kansas City; R. F. Bukacek, Institute of Gas Technology, Chicago; J. M. Phillips, Southern Natural Gas Co., Birmingham; and Earl Humble, Texas Eastern Transmission Corp., Shreveport. Moderator of the panel was Sy Orlofsky, Gulf Interstate Gas Co., Houston. The panel discussion is presented here as a composite set of questions and answers:

Q. What's the best method to determine flow rates?

A. Use of the orifice meter for determining rate-of-flow is most desirable. Obviously, these meters are not installed on every section of the line and industry had to use other methods. Panhandle, for instance, once used a portable pitot tube which was inserted into high-pressure gas lines. It wasn't consistent and results weren't conclusive. Besides it was a costly and laborious procedure. The displacement method then came into being and it has been quite satisfactory.

This method times the movement of a tracer in the pipeline between two points. The pipeline volume between the points is known and the time it takes for this volume to be displaced by the gas behind the tracer gives the rate-of-flow. In early experiments an odorant was used which proved unsatisfactory. Finally, ammonia was used and this has become fairly standard.

Q. How much ammonia do you use and how do you detect it at the downstream measuring station?

A. On high-pressure lines usually ½ lb. will suffice; on low pressure 1-3 lb. The important thing is to inject it rapidly so it travels as a slug.

There are various methods of detection. You can use methyl red or phenolphthalein solution on filter paper and pass gas across the moistened sheet until the color changes. You can get a good indication with a solution of methyl red in alcohol by bubbling the bleed gas through a test tube containing the solution.

Q. Will the test be affected by water in the line?

A. If water is present it will tend to absorb the ammonia and more ammonia may be necessary to obtain an indication. At the same time, water can completely invalidate the results. After hydrostatic testing of a line, it's sometimes necessary to wait as long as 3 months before the residual water is finally removed so that it doesn't interfere with a test. Some pipeliners have experienced trouble while testing gathering facilities. Distillate in the system interfered and they were unable to detect the ammonia.

Q. What is a general method to follow in testing the line via the ammonia-displacement route?

A. Pick out two block valves about midway between compressor stations. Set up injection equipment on the upstream valve and detection equipment on the downstream valve. These valves are generally 8-10 miles apart on main lines. The ammonia is injected and a stop watch is used for timing purposes. Two-way radio is used to communicate this information to the downstream crew. They know approximately how long it will take for the slug to arrive. About 5 minutes ahead of time, start bleeding the sample through the indicator solution. Once the solution changes color, the time is noted and the test run is completed. Other desired readings are made during the test run.

Q. What should be done before starting the test?

A. The big item is to stabilize flow because all calculations are based on steady-flow conditions.

It's pointless to talk about absolute stability, so aim for a relative stability which will provide reasonably accurate answers.

As one rule of thumb; if all measurements within 1 hour give constant values at 10-minute intervals, then you've achieved a reasonable stability. Another rule is to hold pressure at the compressor stations allowing less than 1-lb. change per hour.

Actually, if the change is all in one direction, rather than fluctuating up and down, you can get suitable data with as much as a 3-lb. drop per hour. Then, too, if a second run duplicates

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PIPELINE PATROL

your results, you can reasonably assume stable flow.

Q. What other preparations are needed?

A. Work closely with the dispatching group. They can anticipate a surge in demand which might require peak and uninterrupted flow along the section during the particular week you want to work there. Hence you will reschedule accordingly. Also, you should be sure that no gas is being sold along the test section. Finally, you must take various other measurements such as; specific gravity, temperature, and pressures. Also, determine the equivalent length of line, the supercompressibility factor, and change in elevation between stations.

Q. What temperature should be used?

A. If the temperature change is large, it's best to measure the temperature at varying distances from the station and plot the data to calculate the mean temperature. To do this, use a probing red to contact the pipe underground and then use a long-stem dial thermometer to get the surface temperature of the pipe. This should be within 1° or 2° of the gas temperature.

If the change is gradual, you will get almost a straight-line effect when plotting temperature versus distance, and average temperature will be satisfactory.

Some companies work out a heat-transfer coefficient for each section and you can use such a curve to get the approximate-mean-flowing temperature. A 10° error in temperature, incidentally, causes less than 1 per cent change when calculating efficiencies.

Q. Do you test each section between block valves?

A. Not necessarily. If efficiency is satisfactory on this middle section, assume it's O.K. for the entire distance between compressor stations.

Q. What's wrong with testing short sections of line by the ammonia-displacement method?

A. The main objection is that chances of inaccuracy are increased with short sections. For instance, a 1-lb. error in determining pressure will have a much greater effect on accuracy over a 1-mile section than on a 10-mile section. Also, in determining the exact line length, the errors have effect on longer sections.

Q. Doesn't turbulent flow in the line affect the movement of the ammonia?

A. There's no doubt that the ammonia does not travel physically as a perfect slug. This is proved by a trace of ammonia that remains for some time after the first indication of its arrival at the test station. However, you can assume the leading edge travels as a plug, and hence calculate for an actual-displacement effect during its travel between injection and indicator-test stations.

Q. How do you justify this?

A. Two ways: (1) the best method to determine efficiencies is using orifice meters to determine flow. When the ammonia method is used, over a section where orifice meters are installed, the results taken by both methods compare favorably; (2) results often check within plus or minus ½ per cent when making two test runs with ammonia.

Q. Once you have all your data what method do you use to calculate flow efficiency?

A. One of the most widely used is the revised Panhandle formula.

Q. What is wrong with using the Panhandle-A formula?

A. The difficulty is lack of consistent results when the rate of flow varies in a test section. The revised equation was derived so that no matter what the flow rate was at the time of the test run, the results would be comparable to those made at another time. It is not a perfect tool, but represents a considerable improvement over the earlier formula.

Q. Is the revised formula difficult to work with?

A. No, actually it's probably easier, the only change being in exponents, and a more simple one is now used.

Q. Where might errors creep into your tests?

A. Sources of error can come from: pressure measurements; timing movement of the ammonia slug; omitting a correction for elevation; omitting a deadweight; correction; having an inaccurate-line length; not providing a proper-temperature correction; and getting unstable flow. All of these can be eliminated or minimized by careful adherence to procedures. Some companies try always to use the same divisional personnel in running the tests.

Q. Once you determine flow efficiencies how do you use them?

A. The big use is in deciding when to clean the line. They also can be used in designing future installations, dispatching operations, forecasts, and flow studies.

Q. Do you clean the line when the efficiency drops?

A. Not necessarily. Generally, watch for a trend and then if it develops start pigging. If the efficiency shows a drop, it's wise to run another check before

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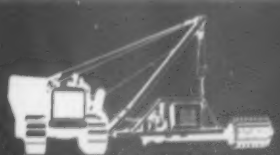
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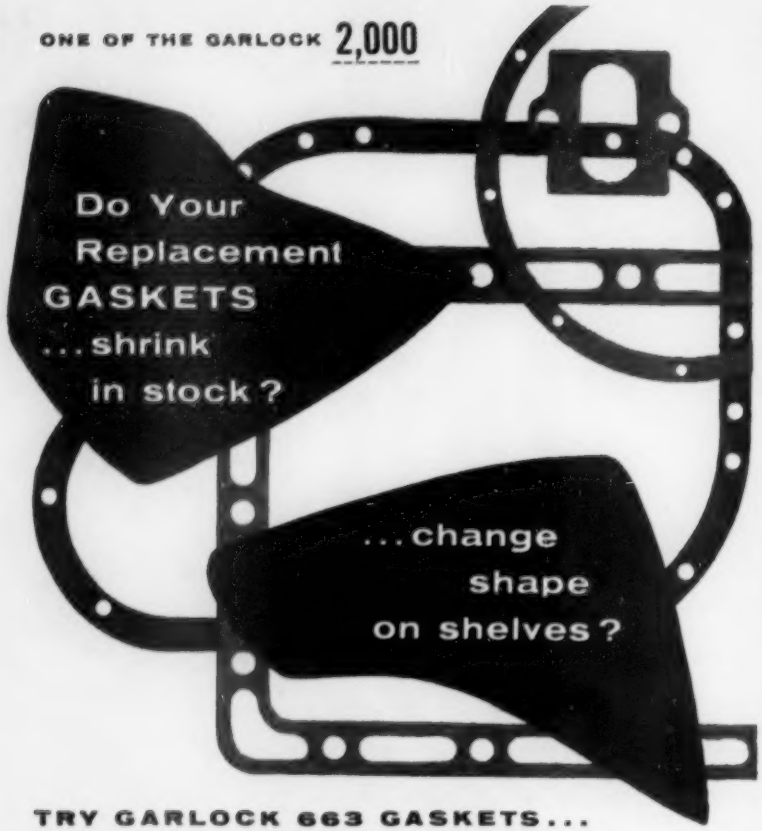

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Pipeline Patrol

pigging, since it may be due to a test error.

Q. If you run a pig and find no improvement in efficiency, how do you explain it?

A. It's probably due to the elevation change having been neglected in the calculations. Some companies will use an airplane-type altimeter or barometer to determine station elevations. These will be subject to climatic errors, but if enough runs are made over the same section, eventually you'll come up with a good firm elevation figure. Additional work could be done on this problem, however.

Q. Is it possible to determine efficiencies by using average monthly figures for sales, temperature, pressure, and inputs?

A. There's been more work done using daily dispatch records for spot checks rather than monthly figures. Some excellent results have been obtained where deadweight pressures were recorded from each station on the hour and where no gas was entered or removed from that section of the line under study.

Q. Is more work being done on the subject of pipeline efficiencies?

A. Yet, quite a bit, both by individual companies and cooperative efforts through such organizations as the Institute of Gas Technology and the A.G.A.

A.P.I. Publishes New Welding Standard

THE American Petroleum Institute has announced publication of the fourth edition of its "Standard for Field Welding of Pipe Lines." This edition reflects developments in pipeline welding that have taken place since the third edition was issued in 1955.

The standard has been elevated and is no longer considered tentative. In addition to several minor changes the fourth edition includes a section that allows multiple qualification of welders under certain circumstances.

The standard and its latest revisions were prepared by a committee that included representatives from the American Gas Association, Pipe Line Contractors Association, Pipe Manufacturers, American Welding Society, Society for Non-Destructive Testing, and the American Petroleum Institute.

Copies of "A.P.I. Standard 1104, fourth edition, Standard for Field Welding of Pipelines" may be ordered from: J. A. McNally, A.P.I., 50 West Fiftieth Street, New York 20. The price is 50 cents per copy.

Newest supply center for offshore drilling

One of the most recent examples of how a National Supply store is designed to meet the specific needs of an area is Venice, Louisiana. Here, on the tip of the Mississippi delta, this fishing village has become the hub of increasing offshore drilling activities. Over 40 offshore rigs are now located in the territory.

As more and more contractors began drilling operations off this part of the Louisiana coast, it became obvious that an on-the-spot supply store was vitally needed. Because it has been our practice for more than 60 years to "follow the fields," a National Supply store was opened there promptly.

In a way, the Venice store is much like our other 125 supply centers. Large, modern building and display room, bins stocked with thousands of service parts and supply items, an equipment yard filled with SPANG tubular goods, National drilling and production equipment. But here the similarity ends and special offshore drilling requirements begin.

At Venice, you'd see crew members, tool pushers or contractors picking up or calling in for oyster tongs, boat paddles, ship scrapers, life jackets, marine lanterns and hundreds of other special items. To provide National Supply's traditional brand of service, fieldmen contact the rigs frequently via crew boat, supply boat or helicopter. Sometimes, it takes a full day to reach, contact and return from one offshore rig.

As we said originally, Venice is only one example of how a National Supply store serves the specific needs of an area. But you can enjoy this tailored service in whatever part of the oil country you may be in. Its job ("offshore" or on shore): to save time and money for you.

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● Leak resistance is just one of the outstanding features of SPANG Extreme Line Casing. You'll also like this quality casing because it has the mechanical and metallurgical properties to withstand high tensile loading, and to resist the severe pressures found in present-day deep drilling. Another outstanding fact is that SPANG Extreme Line Casing can be salvaged and re-run repeatedly.

Drilling crews like to work with SPANG Extreme Line Casing because it's easy to handle. When they're running-in, only 5 to 7 turns with the spinning line and less than one turn with the tongs are necessary. It's very easy to stab, cannot be cross-threaded, and its positive shoulder contact engagement prevents overtonging. But there are more good reasons.

The streamlined interior and exterior contours of this high quality casing provide for maximum running efficiency—no shoulders to hang-up on hole projections, or scrape mud seal from the walls of the hole. SPANG's high strength integral joint provides a minimum of threaded connections—and this means fast action.

You can easily get more information about this quality casing in terms of your specific needs by calling the nearest office listed below, or by asking the National Supply representative in your area. Find out soon how SPANG Extreme Line Casing can save you money in the long run.

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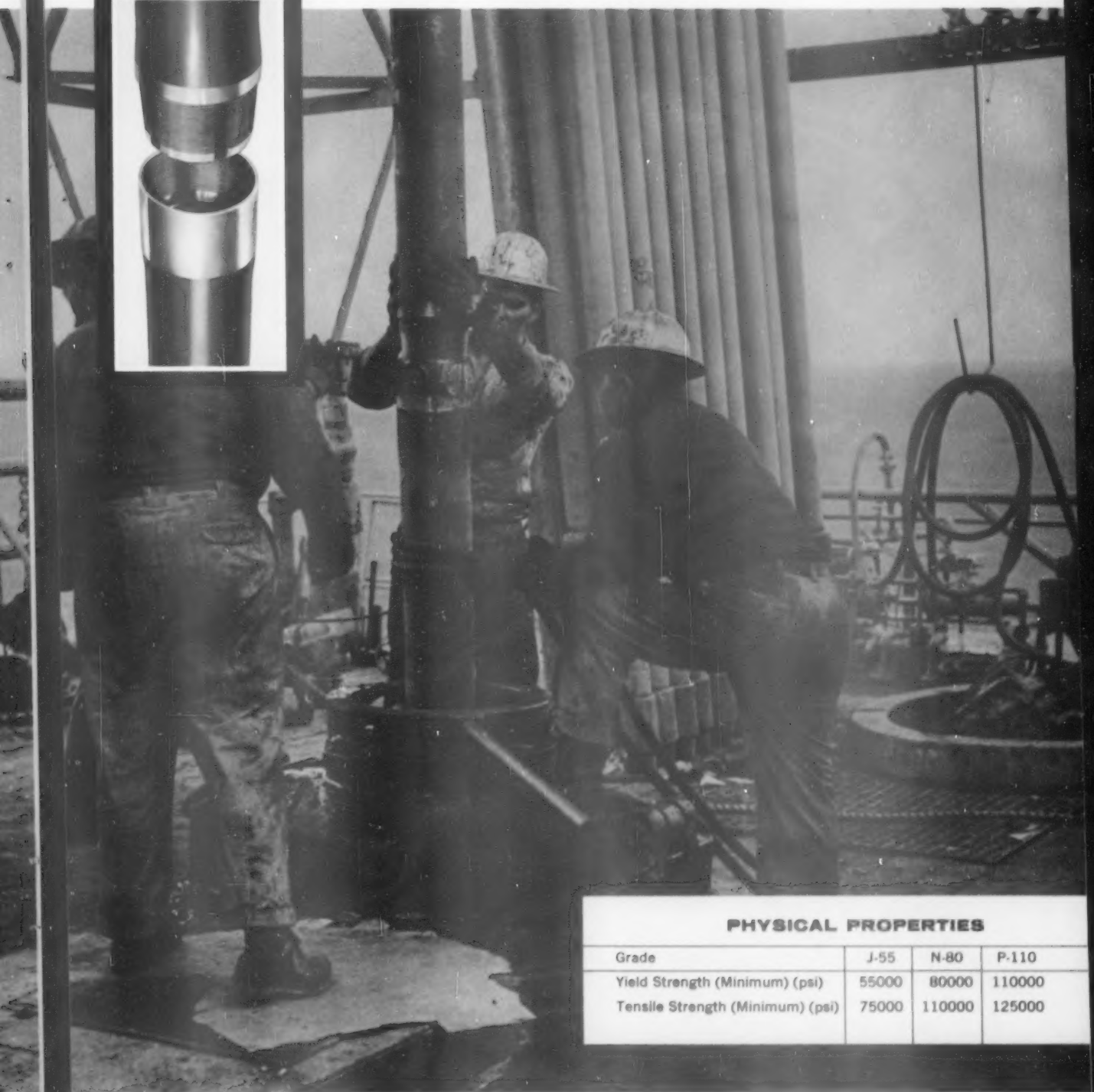

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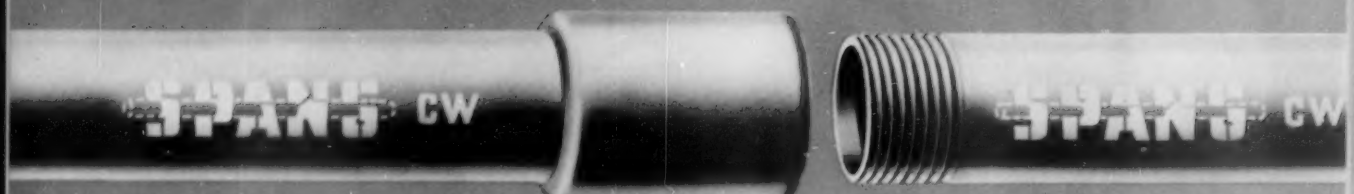
Grade	J-55	N-80	P-110
Yield Strength (Minimum) (psi)	55000	80000	110000
Tensile Strength (Minimum) (psi)	75000	110000	125000

On the next page: another quality Spang product



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OF NEW EQUIPMENT AND LITERATURE

by Dan B. Miller

Flow Meter Compensates, Integrates Continuously

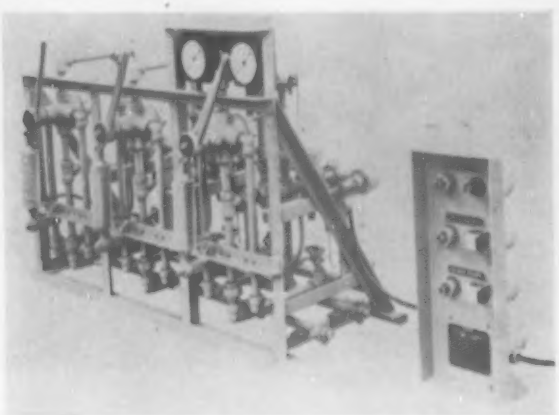
The Model 236 pressure-compensated, continuous-integrating flow meter, consists of the Barton Model 199 ruptureproof bellows unit combined with the Librascope Model 90 pressure-compensated flow computer.

The Model 236 senses differential and static pressure, extracts and continuously integrates their square root values, and totalizes their product. It does this without the use of cams or intermittent devices.

The instrument indicates both differential and static pressure and continuously totalizes flow on a six-digit counter. A built-in pulse switch provides a means for transmitting a remote reading to a control or data-collecting system.

The flow integrator is furnished in differential pressure ranges from 0-20 in. water column to 0-50 psi. with static

pressure ratings up to 6,000 psi. A variety of housing materials are available including aluminum, steel, alloy steel, and stainless steel. The flow integrator is equipped with a 115-volt, 60-cycle, synchronous electric drive with a variety of speeds (counts per hour). Spring-wound or pneumatic drives are optional. **For more information write or call: Barton Instrument Corp., 1429 South Eastern Avenue, Los Angeles 22, Calif.**



Blowout Preventer Remotely Operated

This new electric control manifold with pushbutton remote-closing unit for fast, easy operation of the blowout prevention control system is designed to meet rig-safety requirements.

With the remote-closing unit at the driller's position or at the exit stairway, the automatic-pump accumulator and electric control manifold may be installed at a safe distance from the well. In an emergency, the driller simply pushes the button to shut down the well.

A pilot light beside the pushbutton tells the driller instantly whether the preventer is open or closed. In multiple-station installations all pushbuttons except that for the primary blowout

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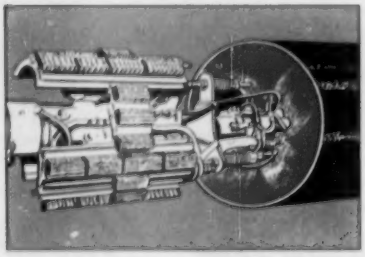
Copon internal pipe coating selected again by major gas transmission company



Thirty and thirty-six inch pipe being automatically spray-painted at mill following unique metal cleaning process.

Proof of COPON'S effectiveness in solving internal pipe coating problems lies in its growing acceptance by major gas transmission companies. This year it's being used again by one leading firm for new 30″ and 36″ pipeline construction in addition to many other projects.

COPON internal pipe coatings offer *even more* than outstanding protection against corrosion losses. They *pay off* in protection during storage, lowered maintenance expense and greatly reduced pigging costs. And COPON coatings make possible delivery of cleaner, rust-free gas products.

Scientifically developed systems are available for coating dehydrated gas lines, crude and petroleum product lines, salt water lines, fresh water lines, and oil well tubing and casing. Write your nearest COPON manufacturer today. He will be happy to show you how COPON can be efficiently applied to new pipe, used pipe or pipe-in-ground.

Get complete information about COPON today.

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Please send me information about COPON Internal Pipe Coatings.

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P. O. Box 546, Denver 1, Colo.

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P. O. Box 8010, Pittsburgh 16, Pa.

preventer are protected with swinging covers so that the wrong button cannot be pressed accidentally. As a further precaution, pushbuttons may be used only to close the equipment; to reopen, the valve on the control manifold must be operated manually.

Operating off the rig lighting service, the electric control system does not require a separate power source. **For more information write or call: Hydril Co., 714 West Olympic Boulevard, Los Angeles 15, Calif.**

●

Two-Stage Pump Designed For Use on Problem Wells

A two-stage sucker-rod pump was designed for wells in which conventional pumping methods are inefficient due to high gas-oil ratio, gas locking, and in wells that must be produced from below a packer without gas separation. It is a rod-type pump with a stationary barrel and is actually two pumps in tandem, a standard pump with a smaller one above it.

The two chambers act directly opposite. On the downstroke the primary chamber is compressing while the secondary chamber is expanding. On the upstroke, the primary chamber is compressing and moving fluid up through the traveling valve and into the production fluid column. The secondary stage by expanding on the downstroke enables the intermediate traveling valve to open at a lower pressure than a conventional pump.

The area of the secondary chamber is one-third the size of the primary chamber and thus provides additional compression to the oil-gas mixture.

Combinations of sizes and stroke lengths are available. **For more information write or call: Axelson Manufacturing Co., Division of U. S. Industries, Inc., 6160 South Boyle Avenue, Los Angeles 58, Calif.**

●

Refinery Catalysts Show High Thermal Stability

Gyrocat high stability catalyst is being produced in four particle size distribution in either 13 or 25 per cent alumina composition. High throughput and cracking severity of today's fluid catalytic-cracking-unit operation subjects the catalyst to increasingly severe conditions of deactivation. Consequently, high thermal stability is a primary requirement of a superior catalyst.

High stability catalysts differ from the previously produced silica-alumina catalyst in physical structure. While their most obvious characteristic is a lower particle density resulting from a more porous structure, superior stability is actually achieved by control of the size and distribution of the filaments constituting the skeleton.

Catalyst pore volume and diameter can be increased by a wider spacing of the skeletal filaments. However, it is also possible to increase the diameter of these filaments while increasing their spacing. It is this practical control of these two structural changes which results in the improved stability of the new product.

Increased pore diameter and pore volume make the catalytically active sites of the catalyst more accessible, contributing to the improvement of activity found in commercial application. For the same reason, the air required to burn coke is reduced. **For more information write or call: Davison Chemical Co., Division of W. R. Grace & Co., Baltimore 3, Md.**

●

Gage-Glass Cleaning Rod Exerts Pressure on Wall

A new and practical rod for cleaning the inside of liquid-level gage glasses uses a cloth swab on the end. The cloth swab can be brought to bear against the inside of the glass to remove stain.

A tubular-cloth swab is slipped over a piece of corrosion-resistant spring steel on the end of the rod. A detergent or other cleaning medium is applied to the swab and the rod is then inserted into the end connection of the gage or the drain in the offset of a valve. When the swab is visible in the glass, simply pull back the handle and tighten the thumb screw. The result is an increased arc of the spring which forces the swab with the cleaning medium snugly against the glass and allows a good cleaning job. **For more information write or call: Jerguson Gage & Valve Co., 80 Fellsway, Somerville 45, Mass.**

●

Counter Records Increase Or Decrease in Radiation

A new scintillation counter directly operates both a standard 1-ma. recorder and an alarm system that can be preset to visibly record either an increase or a decrease in radiation. This ability to record a decrease makes the Gamma gun especially valuable for oil exploration.

The Gamma gun weighs only 6½ lb. complete with batteries. It has an 11-transistor high-gain circuit that insures high stability and accuracy. The counter has a long operating life from four standard flashlight batteries and an internal-calibration unit that offers calibration accuracy beyond the limitations of conventional radium-calibration disks.

The Gamma gun is efficient for airborne, car-borne, and foot prospecting and surveying. **For more information write or call: Universal Atomics Corp., 19 East Forty-Eighth Street, New York 17, N. Y.**

●

Pumping Unit Designed For Depths to 1,500 Ft.

The U2-DR64 pumping unit is suitable for well depths down to 1,500 ft. Its outstanding feature is the large 15.4-in. sheave to give low pumping speeds when using a 1,750 r.p.m. motor.

Other advantages are removable head for well clearance, heavy frame structure for trouble-free service, heat-treated alloy helical gears and double-reduction gear box, and heavy-duty self-aligning bearings. All shafts in gear case are equipped with tapered roller bearings. Pipe skids for the

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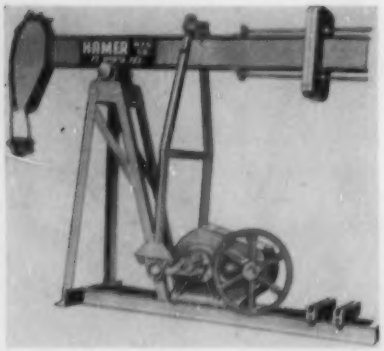

pumping unit are constructed of 3-in. line pipe for the runners and unit base rails have 3-in. pipe braces. **For more information write or call: Hamer Manufacturing Co., 5504 Forest Hill Drive, Fort Worth 5, Tex.**

●

Tube Collector Boosts Gas Cleaning Efficiency

A mechanical collector of the multiple-tube type, the Cyclo-trell, has a higher collection efficiency and a greater gas flow for a given pressure drop than has been previously obtainable in conventional multiple-tube collectors. The greater capacity means fewer tubes per unit are needed, resulting in a lower total cost for a given capacity and efficiency.

The Cyclo-trell consists of a series of cyclone tubes arranged in parallel and depends on centrifugal force for its operation. The incoming gas enters the chamber under pressure and flows into the lower set of inlet tubes which

are attached to the lower header plate and are of slightly larger diameter than the upper outlet tubes. Inlet vanes at the mouth of the inlet tubes set up a circular motion in the gas so that suspended particles are forced downward and outward against the wall of the inlet tube. Cleaned gas is first forced toward the center of the collector tube and then upward and into the outlet tube by the pressure differential.

The shell and hopper of the Cyclo-trell are of seven-gage bolted-steel construction, with cast-iron inlet tubes and vanes to resist the abrasive force of incoming gas. **For more information write or call: Research-Cottrell, Inc., Bound Brook, N. J.**

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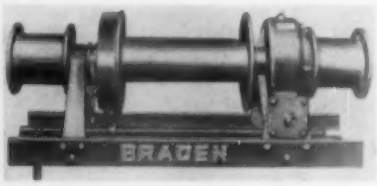

Truck Winch Rated at 20,000-Lb. Capacity

The new MS10-18B winch has a 20,000-lb. capacity. It is designed for 1½ to 2½-ton trucks. In addition to the oil-cooled automatic safety brake, the MS10-18B features a heat-treated, alloy-steel, detachable-drum clutch plate. It has a thrust ring inside so that the worm housing will carry the thrust of the cable drum in either direction. A band brake on the cable drum and full cab controls for both drum brake and clutch are standard equipment on the MS10 winch.

The alloy-steel drum shaft makes increased winch-load capacity possible. The winch also incorporates an aluminum-bronze worm gear and heat-treated drum shaft keys. **For more information write or call: Braden Winch Co., P. O. Box 547, Broken Arrow, Okla.**

●

Lightweight Flat-Type Motor Takes Minimum Space

This new flat-type motor provides maximum horsepower with minimum size. It comes in totally enclosed fan-cooled or totally enclosed nonventilated designs.

Designed to meet the specifications for NEMA design B motors, the new motor was developed for use where there is a minimum of space.

Weighing considerably less than standard motors, these units are of standard radial design, constructed like conventional squirrel-cage motors. Easy to disassemble and easy to reassemble, there are no precision alignments or complicated air-gap adjustments with which to contend. An important design feature is that the rotor weight is

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evenly supported between two ball bearings.

Operating at 208, 220/240, or 550 volts, 2 or 3-phase at 60 cycles, continuous or intermittent duty, the motors are available in ratings ranging from ⅓ to 7½ hp. They are also available for special voltages. **For more information write or call: Diehl Manufacturing Co., Finderne Plant, Somerville, N. J.**

Road-Crossing Bushing Made in Wider Size Range

Improved WmSeal Z bushings for pipelines in casing under highways and railroads are now available for all sizes of line pipe down to 2 in.

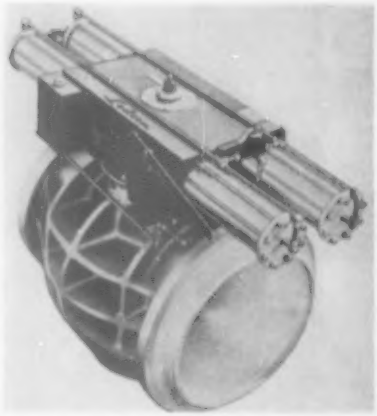
New design features include stainless-steel bands and clamps which provide a tighter seal and are hand tightened. This solid ring of tough, synthetic rubber withstands the weight of

backfill earth and effects a perfect seal on bare pipe as well as on coated pipe. The extra-thick shoulder incorporated in this design prevents the casing edge from cutting through the bushing.

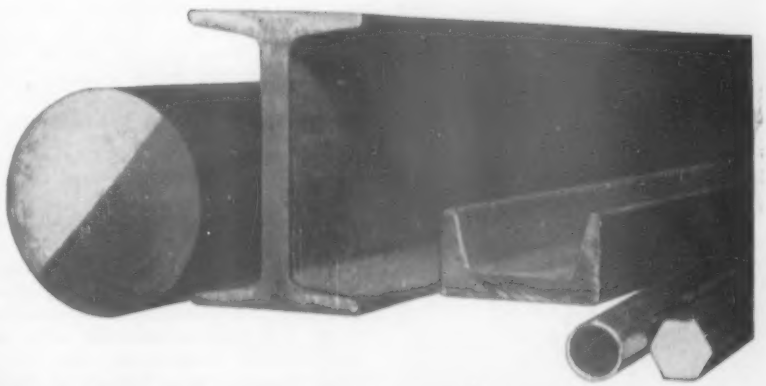
Spliced Z bushings, including a cold-patch kit, are available for installation on lines already in service. **For more information write or call: T. D. Williamson, Inc., P. O. Box 4038, Tulsa 9, Okla.**

Valve Actuator Delivers Balanced Stem Torque

Built to operate high-pressure plug and ball valves up to 36 in. in size, the Quad actuator features balanced torque delivered to the valve stem through four-cylinder operation. The gas and oil systems are entirely separate. There is no gas-oil interface. A detachable lever permits operation of actuator and controls without turning main valve. Field installation without modification of valve is easy. **For more information write or call: Ledeen Manufacturing Co., 1600 South San Pedro Street, Los Angeles 15, Calif.**



call Ryerson for steel carbon, alloy, stainless



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OIL AND GAS JOURNAL Showcase

- BULLETINS
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Accurate Jet Perforating. Performance of tools for simultaneous gamma-ray logging and jet perforating is described in Bulletin B-2026. The new bulletin lists advantages of the combination tool and associated instrumentation, gives examples of results obtained, and locations of field stations in Mid-Continent and eastern oil fields. **For more information write or call: Birdwell Surveys, Bradford, Pa.**

●

Canadian Petrofina. A report of the construction of Canada's newest refinery is given with four-color illustrations in the last issue of Kelloggram. Schematic flow diagrams show the unusual combination of vacuum distillation with five catalytic processes. The advanced instrumentation and control system features automatic recording of raw data and computation of complex factors such as total flow. **For more information write or call: The M. W. Kellogg Co., 711 Third Avenue, New York 17, N. Y.**

●

Coseley Standard Steel Framed Buildings. This new 28-page, 3-color booklet describes the range and adaptations possible with a complete line of steel buildings. The booklet presents a range of sizes, specifications, details of construction, and photographs of installations. **For more information write or call: Coseley Engineering Co., Ltd., Dock Meadow Drive, Lanesfield, Wolverhampton, England.**

●

Gyrol Fluid Drives. A new four-page, four-color Bulletin 9919 covers application of Gyrol fluid drives in the petroleum industry. The bulletin describes the adjustable-speed Gyrol units and outlines their advantages as applied to drilling rigs, pipeline-compressor stations, refineries, and other petroleum-industry applications. A cross-section drawing, which includes a flow diagram, illustrates the operation of the new Type VS, Class 2F unit. Among the specific installations discussed are draw works, rotary, slush pumps, and compounding for drilling rigs; jacket-water coolers, pumps and byproduct reclamation for pipeline-compressor sta-

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Available in three sizes, the NATIONAL AIROIL Dual Stage Burner fires all grades of fuel oil from No. 2 to No. 6, with a ready capacity of 80 to 300 g.p.h. Further, for a perfect flame pattern, we would recommend using with the Dual Stage Burner either the NATIONAL AIROIL Universal Register for forced draft, or the NATIONAL AIROIL Tandem Unit for natural or induced draft furnaces.

Get detailed description, illustration, and specifications in NATIONAL AIROIL Bulletin 25.

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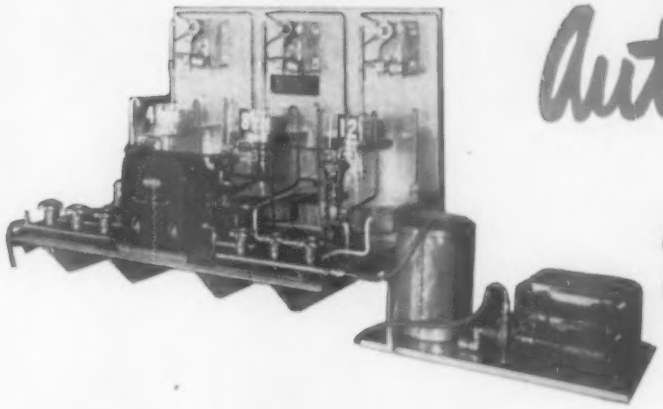


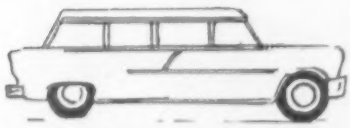
Automatic Tank Switching Unit

Prime example of MECO engineering — integrating precision components into flexible production units — is the new tank switching unit, in which a single selector-controller is used for a multiple tank battery operation.

It is composed of (1) Masoneilan Automatic Selector-Controller (designed to carry two to twelve tanks in one battery), (2) liquid level controllers, (3) interlocks which hold the fill-valve closed when oil is drained to pipeline or recirculated, (4) pressure gauges showing whether tank is being filled, drained or recirculated.

Entirely pneumatic with selector-controller and gauges panel-mounted, the unit may be operated by compressed air or gas. The Masoneilan Selector-Controller has a standard weatherproof case and non-bleed pilot features, and provides continuous scanning of all tanks in the battery.

The assembly is available from stock as a complete package with interlocking features and standard components known for their durability, compactness, and dependability.



The complete working model of the MECO Automatic Tank Switching Unit is on tour in Texas, Louisiana and Mississippi. Dates for demonstrations in your area are available on request.

FOR DETAILED INFORMATION, WRITE, WIRE OR PHONE:

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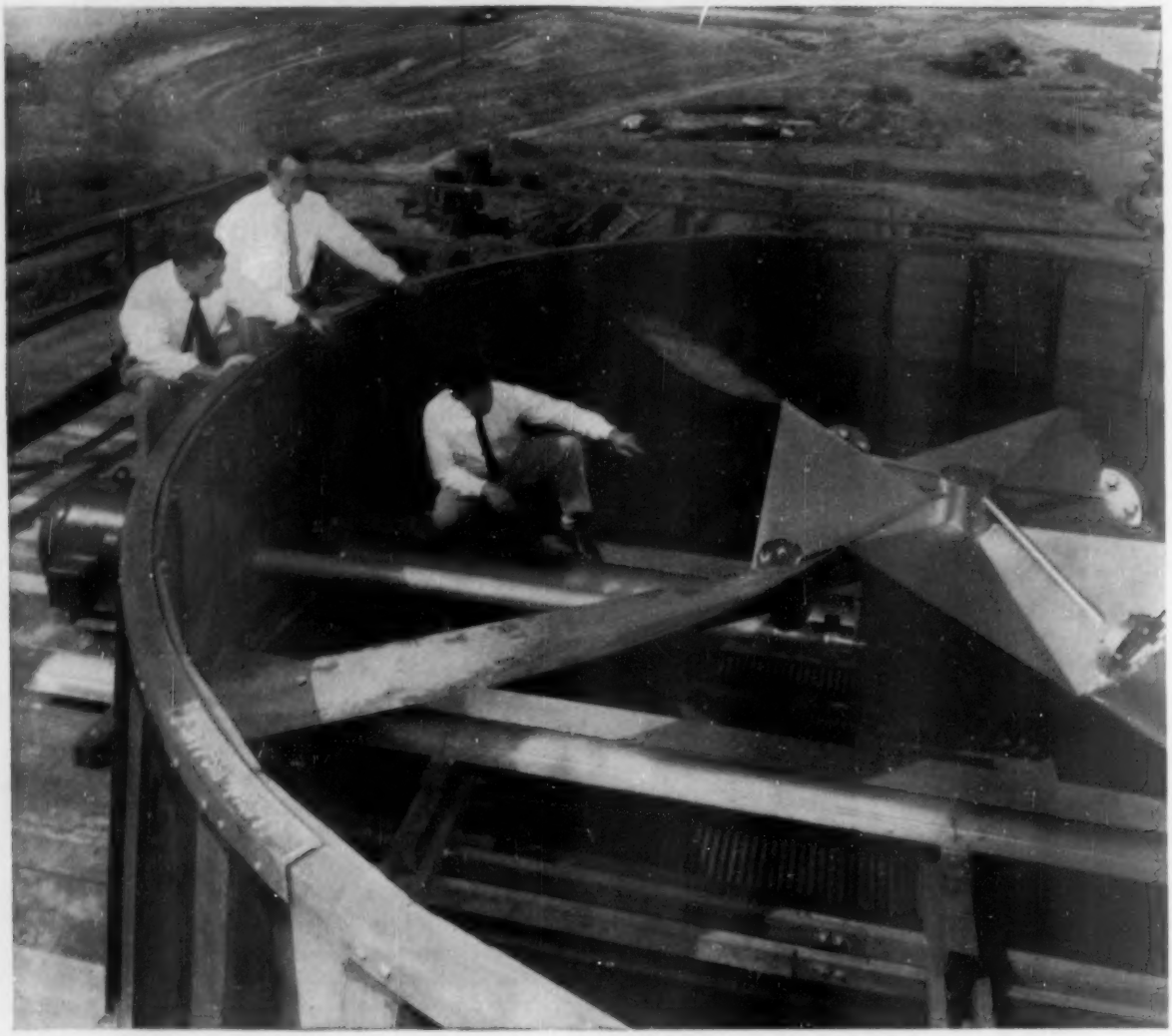
SUBSIDIARIES: Coastal Engineering Corporation
New Orleans, Louisiana
Proveedores Tecnicos, S. A.
Mexico D. F., Mexico



"Here's why I say Pritchard's drive support is the best!"

"I can see one thing that makes it stronger already, Ed."

"You mean the one-piece welded construction?"

"Yes. That heavy structural steel certainly looks strong. What about the mounting, Ed?"

"That's another big feature of this Pritchard tower. You can't tell it just by looking at it, but the speed reducer and driver are aligned first—then the driver and reducer are doweled for permanent alignment."

"Is that important?"

"Definitely! It gives all the assurance you'll ever need that the drive alignment will stay that way."

"Don't you fellows overlook the way the supports transmit the operating and dead load uniformly to the tower framework!"

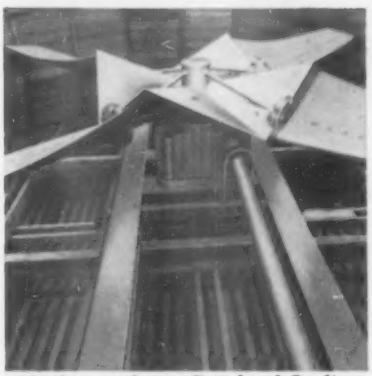
"Don't worry, Mel, we haven't overlooked a thing."

"Neither did Pritchard! That's why we bought this tower!"

J. F. PRITCHARD & CO. OF CALIFORNIA
4625 Roanoke Parkway, Kansas City 12, Mo.

"Here's why I say Pritchard's drive support is the best!"

Stronger support is just one reason for Pritchard drive assembly superiority!



The bigger, better Pritchard Cooling Tower drive assembly gear speed reducer has many special features.

For example, it has superior shaft seals, heavier bearings, more conservative horsepower ratings, more rigid housing, more positive lubrication *than any other speed reducer available!*

Pritchard all-metal drive shaft couplings require no lubrication. Drive shaft guards are furnished as standard equipment.

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tions; and catalytic reforming processes, centrifugal and positive-displacement pumps, and catalyst rejuvenators for refineries. **For more information write or call: American Blower Corp., Detroit 32, Mich.**

●

Cyclator and Sediflotor Clarifiers. Two new 12-page, illustrated bulletins describe equipment and systems for industrial waste treatment. Bulletin 850, the Cyclator clarifier, contains flow diagrams and descriptions of waste-treatment systems involving chemical precipitation, coagulation, and sedimentation. Bulletin 6051, the Sediflotor clarifier, discusses the application of flotation to industrial waste treatment. **For more information write or call: Infilco, Inc., 901 South Campbell Avenue, Tucson, Ariz.**

●

Surface Armor Specification and Installation Manual. A 12-page manual illustrates the latest methods for prolonging the life of industrial floors with Hexteel and Floorsteel heavy-duty, steel-floor armors. Hexteel is a rigid armor while Floorsteel is a flexible steel armored mesh. This hard-back-covered report contains several pages of data tables, filler weights, specifications, illustrated installation procedures, and various specialized uses of Hexteel and Floorsteel. **For more information write or call: Klemp Metal Grating Corp., 6615 South Melvina Avenue, Chicago 38, Ill.**

●

Flo-Klean Filters. Filters for raw water, light-process liquids, and centralized-coolant systems are described in the 12-page, revised Bulletin 052 on Flo-Klean filters. These filters can handle up to 15,000 g.p.m. in a single unit and can filter down to 0.0025 in. They are continuously and automatically self-cleaning, require minimum maintenance, and occupy small floor area. **For more information write or call: Cuno Engineering Corp., Meriden, Conn.**

●

Oil - Field Equipment Catalog. A revised, paper - backed catalog contains 107 pages of oil-field specialty equipment. Some of the products offered are rod lubricators, stuffing boxes, polish-rod liner clamps, and other production equipment. Drilling-line oil savers are included. A section on rubber packing and accessory items includes crown rings, sand-line oil-saver packing, sucker-rod stripper rubbers, and crown dust deflectors. Ten pages of ring packing for rod and stuffing box or for fluid end of pumps is offered in a variety of different sizes. **For more information write or call: Skinner Brothers Co., 1317 East Fifth Place, Tulsa, Okla.**

●

This Is Bingham Pump, a 16-page, 2-color booklet, illustrates plant facilities geared to design and manufacture pumps for a broad range of conditions. Pictured are the stages of manufacture, the rigid inspection system, production equipment, and special test equipment. **For more inforamtion write or call: Bingham Pump Co., 2800 Northwest Front Avenue, Portland 10, Ore.**

●

Corban for Preventing Corrosion in Oil and Gas Wells. This two-color file folder contains 10 bulletins giving the physical properties, description, use, and packaging of the different types of Corban. Corban is a line of inhibitors developed to combat corrosive fluids in oil and gas wells. Methods for testing the effectiveness of corrosion inhibitors are explained. The folder illustrates with photographs the different ways Corban is injected. **For more information write or call: Dowell Incorporated, P. O. Box 536, Tulsa 1, Okla.**

●

60-600 B.Hp. Engines. A four - page, three-color folder gives information on a line of engines for oil-field equipment, compressors, trucks, and boats. Included are four, six and eight-cylinder supercharged and standard engines. Curves are plotted for each engine to show torque, brake horsepower, and fuel consumption. A power pack is featured by this British manufacturer using two coupled six or eight-cylinder engines, offered with a normal gearbox ratio of 1.65 to 1. **For more information write or call Rolls-Royce, Ltd., Oil Engine Division, Derby, England.**

●

Klinger Catalog of Jointings, Packings, Cocks, Level Indicators, and Valves. A complete line of products is described in this leatherette, 170-page, loose-leaf binder. Tabbed dividers separate pages giving information on gasket material, packing, cocks, level indicators, piston valves, stream valves, and disk valves. Photographs and drawings illustrate the different items listed. This complete catalog by a British manufacturer also lists its branch offices and agents throughout the world. Samples of different gasket material are enclosed. **For more information write or call: Richard Klinger, Ltd., Klingerit Works, Sidcup, Kent, England.**

EQUIPMENT MEN . . . in the News

Welex Appoints Patten, Foster, and Williamson

C. T. Patten has been appointed district manager of the new Houma, La., office of Welex Jet Services, Inc.;

C. T. PATTEN

H. D. FOSTER, JR.

Herman D. Foster, Jr., has been named assistant district manager of the Wichita Falls, Tex., office; and Denzel E. Williamson has been appointed a sales engineer for the district office at Pauls Valley, Okla.

Patten has served as a rigger, shooter, sales engineer, and assistant district manager during his 6 years with Welex. Foster, who has been with Welex 3½ years, had worked as a rigman, a shopman, shooter, and sales engineer before his promotion. Williamson has been with Welex 3 years, serving as a rigger and logger.

Bass Becomes Manager of J&L Chicago Sales Office

L. O. BASS

Recent appointment of Loren O. Bass as manager of Jones & Laughlin Supply Division's Chicago sales office has been announced by Rainey Elliott, president of the firm headquartered in Tulsa. Bass has been with the firm since 1950, when he was assigned as a storeman at Perry, Okla. In 1953 he was transferred to Chicago as a salesman and held that position until his recent advancement.

Wallace, Whitaker Named To Atlas Pipe Sales Posts

R. B. (Bob) Wallace has been appointed sales representative in the Oklahoma-Kansas area for Atlas Pipe, Inc., and Norman M. Whitaker has joined the firm as a salesman.

Wallace's experience includes 7 years with Hydril Co., the last year of which was spent as a sales engineer in Oklahoma - Kansas - Texas Panhandle area.

Prior to joining Atlas, Whitaker was with Schlumberger Surenco, S.A. in Venezuela for 4 years, first as an engineer, then as production services chief.

Millard Is American Steel And Wire Sales Manager

M. D. MILLARD

Maxwell D. Millard has been appointed general manager of sales of the American Steel & Wire Division of United States Steel Corp., according to Harry M. Francis, vice president of sales for the division. Millard previously was director of distribution and availability in the commercial department of the Pittsburgh headquarters of U. S. Steel.

Millard will supervise the sales activities of 250 salesmen and specialists in selling the wire division's steel products. Millard started in 1934 as a technical apprentice in the New Haven mill, became foreman there, and in 1949 became district sales manager in Detroit. In 1953 he was named assistant general sales manager at Cleveland and in 1954 became director of distribution and availability.

O'Connor Tells Nomads About Russian Turbodrill

John B. O'Connor, executive vice president of Dresser Industries, Inc., and Don Collins, of Republic Steel Co. and president of the Tulsa Chapter of Nomads, are shown at the May 25 meeting at the Mayo Hotel. O'Connor, who has traveled extensively in the oil-producing countries of the world, gave an enlightening talk on the Russian turbodrill.

Yancy Assigned to O-C-T Product-Development Work

J. R. YANCY

J. R. (Dick) Yancy has joined Oil Center Tool Co. in Houston and will be assigned to product-development work, John Maher, O-C-T president, has announced

Until recently, Yancy was vice president in charge of engineering and manufacturing and a member of the board of directors of A-1 Bit & Tool Co. Prior to service with A-1 Bit & Tool, he was with Gray Tool Co. doing engineering and development work on fishing tools and well-control equipment.

Bovaird Names Sales And Management Appointees

Stephen J. Raphel, former manager of Bovaird Supply Co.'s tubular department, has been named assistant to

S. J. RAPHEL

F. J. ROBBINS

the sales manager to specialize in personnel training and pipe-sales promotion throughout the company's stores and sales offices. Francis J. (Doc) Robbins has been promoted to manager of the tubular department and will supervise all phases of pipe distribution. These appointments were announced by Raymond E. Batchelor, vice president and sales manager of Bovaird.

Especially prepared material, flip charts, and moving pictures will be used by Raphel to initiate the training program, and at least 36 presentations will be made during the rest of this year.

Raphel has worked in tubular sales for Bovaird for 30 years. Robbins, who joined Bovaird in 1924, has advanced from store operations to field sales, and for several years prior to his new assignment he had been Oklahoma dis-

trict manager, headquartering in Oklahoma City.

Schlumberger Appoints W. W. Goode, F. L. Bryan

W. W. Goode has been named assistant manager of Schlumberger Well Surveying Corp.'s southeast area in

W. W. GOODE

F. L. BRYAN

New Orleans. Formerly, he was Permian basin division manager at Midland. F. L. Bryan has replaced Goode in Midland. These personnel changes were announced by W. J. Gillingham, executive vice president of Schlumberger.

Goode has served the company in various managerial capacities in Houma and Lafayette, La., Tulsa, and Midland. Bryan has served as district manager at Coalinga, Calif., and as manager of the Pacific Valley division at Bakersfield, Calif.

Jack E. Human Joins Emsco

Jack E. Human has joined Emsco Manufacturing Co., according to L. M. Bush, California sales manager. Human will devote his time to the sale of Emsco swivel joints as well as structural and galvanizing departments.

Human comes to Emsco after 5 years with Associated Piping & Engineering Co.

Crane Makes Sales and Branch Appointments

The appointment of J. W. Greene as director of industrial sales for Crane Co. and naming of Robert E. Penney as director of branches have been announced by Frank F. Elliott, president. Penney fills the position made vacant by the death of Jess A. McMurry.

Greene was district manager of sales in the east, with headquarters at Long Island City, N. Y. Since joining Crane in 1936, he has been industrial sales manager and assistant manager at the firm's Chicago branch; sales manager at its New York branch, and assistant manager of the valve and fitting sales department at Crane's general office, Chicago.

Penney, who has spent 31 years

Safety for an aircraft test facility at Pratt & Whitney Aircraft Plant, using BS&B Model DV Rupture Discs.

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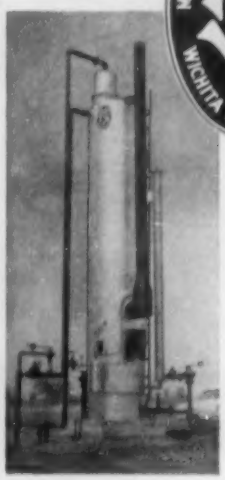

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Steel Fabrication for the Oil Industry

with Crane's branch and general-office staff, has been manager of the company's branches at Phoenix, Ariz.; Jacksonville, Fla., and Los Angeles. He served as western district manager before being named executive assistant at the firm's Chicago office in 1954.

Muldrow Names Regional Sales Representatives

W. R. McBRAYER

G. E. SCHNEIDER

W. R. McBrayer has been appointed regional sales representative of the Rocky Mountain area of Muldrow Aerial Surveys Corp., and G. Eugene Schneider has been named regional sales representative of the West Texas-New Mexico area.

Previously, McBrayer was with Western Co. In his new position he will maintain offices in the Mile High Center, Denver. Schneider, who was formerly in the land department of Tidewater, will be based in Midland.

Waukesha Officials Attend New Iberia Open House

Waukesha Sales & Service, Inc., has opened new sales and service facilities in New Iberia, La., according to Louis M. Pearce, president.

J. E. DeLong, president of Waukesha Engine Co. of Waukesha, Wis., headed a delegation of officials attending the recent open house at the new quarters. Others attending were F. C. Schulze, sales manager; G. A. Duncan, Mid-Continent sales manager; and E. R. Rutenber, chief installation engineer. Attending from Waukesha's Houston headquarters were Pearce; Charlie Zagst, sales manager; Frank Williams, assistant sales manager; J. L. Kluppel; and Walter Buehring.

Serving Waukesha Sales & Service in New Iberia are J. W. Krenek, district engineer, and Louis Peltier, branch engineer.

Sales Promotions Are Announced by Security

W. C. Gray has been named special sales representative for the Mid-Continent region by Security Engineering Division, one of the Dresser Industries. At the same time, T. H. Patterson was promoted to Oklahoma division sales manager to fill the position vacated by

W. C. GRAY

T. H. PATTERSON

Gray. Both promotions were announced by A. M. Birnie, vice president in charge of sales.

Gray has been with Security since 1945. He was promoted from salesman to division sales manager in 1947, serving first as Gulf Coast manager and later Oklahoma division manager. Prior to joining Security, he was with Halliburton Oil Well Cementing Co.

Patterson joined Security as a salesman in 1948 and has since held the title of district manager and assistant division manager.

H. C. Smith Greets New Members of 20-Year Club

H. C. Smith, president of H. C. Smith Oil Tool Co., congratulates new members of the company's 20-year club. Each man was presented with a diamond service pin representing 20 years with the company. Shown are H. C. Smith, president; Arthur S. Marshall, vice president, sales; Otto C. Schmidt, quality-control manager; M. L. McAlister, production manager; Raleigh Allen, assembly foreman; and Herschel C. Smith, executive vice president.

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A 50 YEAR EXPERIENCE

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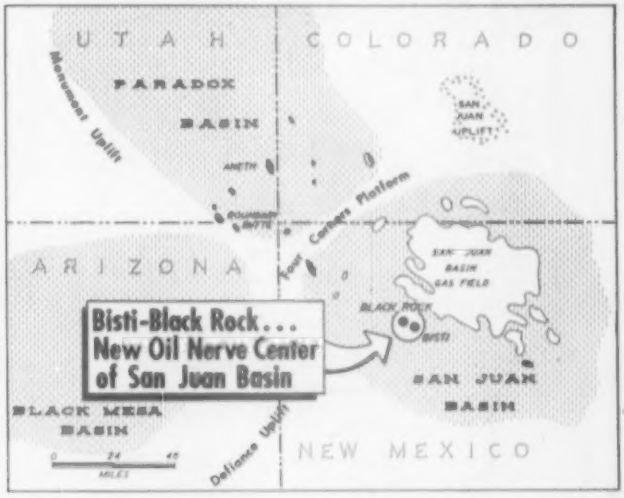


Geologists are intrigued with . . . . . Bisti-Black Rock. Foresee

New Era in San Juan Basin Exploration

by John C. McCaslin

THE days of predicting a bright oil future for the San Juan basin have ended. That bright future is here. The major gas-producing basin of the Rocky Mountain province is entering a sparkling new era of oil exploration, placing the Four Corners region near top in national exploratory interest this year.

Bisti-Black Rock is born . . . The center of oil attraction in the San Juan basin is Bisti-Black Rock Gallup field, a prolific new Upper Cretaceous producing area in San Juan County, New Mexico. A few short months of development have already indicated a producing area of at least 40,000 acres in this fastest-growing new field in the Rockies. The strat-trap prize of the year will produce over an area 4-7 miles wide at least, and 10 miles long or more, trending southeast-northwest.

At mid-June there were 40 wells in the area, including 12 producers, drilling wells, and locations. Sunray-Mid-Continent Oil Co. leads the drilling campaign at Bisti, while British-American Oil Producing Co. commands development at Black Rock. Other companies, including El Paso Natural Gas Co. which opened the Bisti play last year, have entered the contest . . . Amerada Petroleum Corp., Shell Oil Co., Phillips Petroleum Co., and Magnolia Petroleum Co.

The well that fathered this burgeoning reservoir is El Paso's 1 Kelly-State, completed in 1955 for 180 bbl. of oil daily on ¼-in. choke from the Gallup sand. A few weeks ago this well was recompleted for 646 bbl. per day.

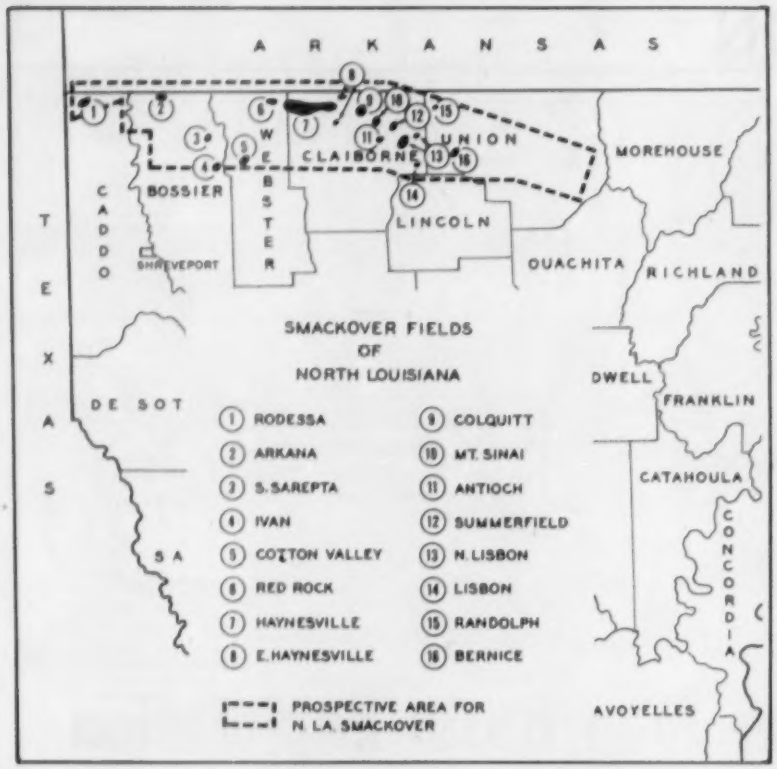
Develops rapidly . . . The real catalyst for Bisti-Black Rock's astonishing rise as a major discovery for the southern Rockies was British-American's 1 Marye, 4 miles northwest of the El Paso discovery. This prolific strike made 595 bbl. of oil daily on ¾-in. choke. Later extensions flowed as much as 900 bbl. per day. The Marye discovery was drilled on the basis of surface and subsurface geology (three strat tests), and on the strength of El Paso's success at Bisti. B.A. holds 12,000 acres in the area.

Sunray entered the campaign at Bisti, coming up with its first oil well in the basin last spring. The 1 Federal "B" flowed 720 bbl. of oil daily, followed by the 1 Federal "D," 2 miles northwest, which flowed 288 bbl. per day. Sunray has more than 5,000 additional acres at Bisti, and is moving rigs into other locations.

. . . The Gallup. The Gallup sand is not exactly a new pay for the region, but it rarely appears on completion tickets or in the literature. The sand is a member of the Mesaverde formation, and is closely related to the Hospah and Tocito sands. It overlies conformably the Mancos shale. Thickness ranges from 180-250 ft., and the sand is widespread throughout the San Juan and Zuni basins. It is found at 4,600 ft. at Bisti-Black Rock where all wells produce around 4,800-4,900 ft. Permeability of the sand fluctuates drastically from a high of 374 to a low of 0 md.

Looks ahead . . . As a result of the tremendous potential of Bisti-Black Rock, and Aneth in the Paradox basin, the oil hopes of the Four Corners region are reaching fever heights.

Sinclair Oil & Gas Co. announced a wildcat-drilling schedule for the west side of the San Juan basin to the tune of 24 tests. The company acquired 260,000 acres of Santa Fe Railroad lands in San Juan and McKinley counties, New Mexico, adding this to the 60,000 it already had. The 24 wildcats will take a look at the Hospah-Gallup sands. The outcome will be eagerly awaited by regional oil hunters. As is the case in all new wildcat country, the oil possibilities await only the drill. *(See page 165 in June 25 issue of The Oil and Gas Journal for more detailed information on Bisti-Black Rock well data).*



SEVEN NEW SMACKOVER oil fields have been found in North Louisiana since the discovery of Colquitt in 1953. Fig. 1.

Formation presents complex problems but . . .

North Louisiana Smackover Deep Tests Pay Off

by R. Lee Rogers

THE Jurassic Smackover formation of North Louisiana has presented complex problems for all angles of the exploration and production segments of the oil industry since production was first established at North Lisbon field in March 1941.

- For the geophysicist, the problem — still unsolved, as far as we know — has been to devise techniques to obtain reliable reflections which represent the true structural attitude of the Smackover formation.
- For the subsurface geologist, the problem has been to properly interpret structural attitude and stratigraphy while seeking structural traps, coincidental with sufficient porosity and permeability, for commercial production. Great strides have been made in this category in recent years because of increase in the density of holes drilled plus concentrated study.
- For the drilling engineer and contractor, the problem has been to increase penetration rates economically to reduce the cost of the 10,000 to 12,000-ft. holes necessary to reach the Smackover formation. Much progress has been made in this category in recent years because of better drill bits and mud programs.
- For the landman, the problem has been the establishment of voluntary spacing agreements among operators and landowners in advance of drilling. A reasonable return on the considerable investment required for Smackover exploration must be assured.
- For management and capital, the problem is the amount of their exploration and development budgets to be allocated for Smackover exploration.
- For those who have been both judicial and successful, the results have been gratifying.

Early efforts discouraging . . . Development drilling for the Smackover gas-distillate production found at North Lisbon field in March 1941 was disappointing and, therefore, short lived; with six wells drilled during 1941, 1942, and 1943. Of these, two were productive from the Smackover and the others were nonproductive.

This development drilling did, however, discover the more important Cotton Valley gas-distillate production of the field. It also first pointed up the big essential difference between Smackover oil and gas fields of North Louisiana and those in South Arkansas. In these fields a concentrated and prolific exploration and development campaign for this formation had been in progress since 1936.

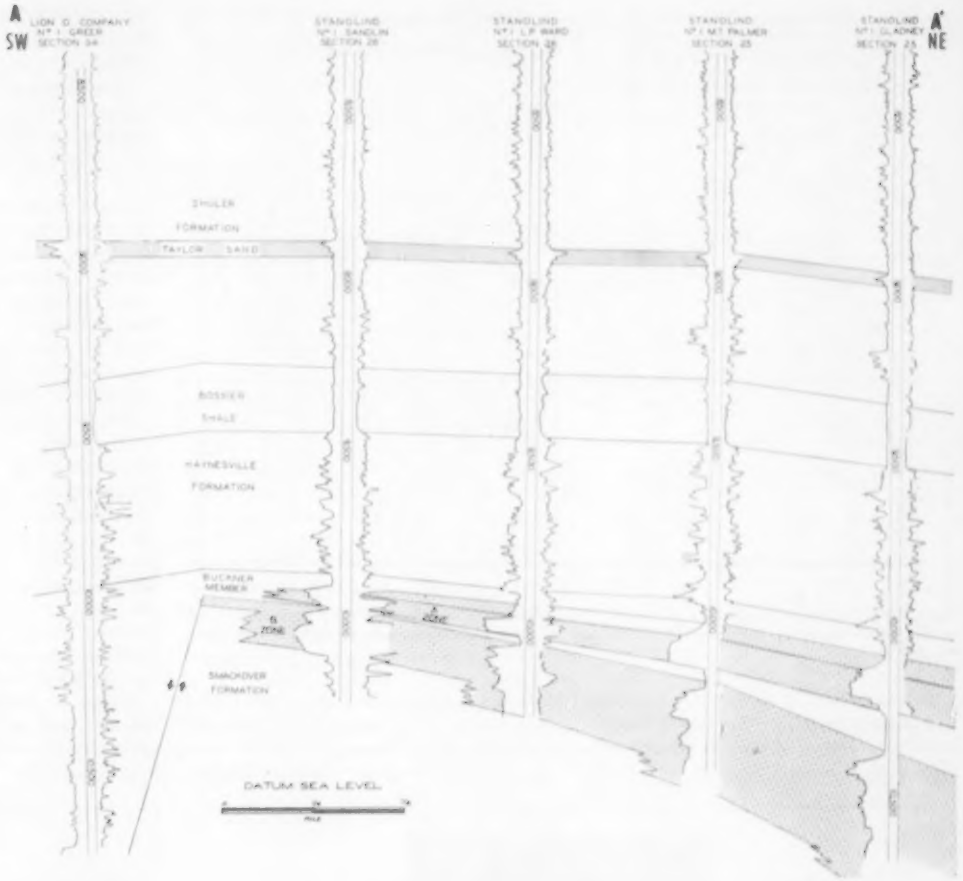
The big difference, other than cost of exploration and development, is this: In South Arkansas, Smackover pools usually are not complicated by faulting. The faulted anticlines of the graben system of South Arkansas have proved to be very poor places to look for Smackover production.

This is because the porous basal sands of the overlying Cotton Valley, against which the Smackover is usually faulted, fail to offer an effective seal and thereby fail to allow a trap to be formed. But in North Louisiana, Smackover pools are associated usually with graben-faulted anticlines. Here, the basal Cotton Valley and Haynesville sands are usually extremely tight or, where porous, are productive as relatively low-volume reservoirs.

Exploration problems . . . With mere mention of it, exploration for Smackover production on graben-faulted anticlines does not sound extremely complicated to the average experienced Gulf Coast geologist or geophysicist. However, one of the two big complicating factors is that faulting associated with North Louisiana Smackover production is restricted to the Smackover formation only.

The formation itself is faulted, but not the 9,500 to 12,000 ft. of sediments, involving several major unconformities, covering it. Add this point to the fact that seismic reflections from the Smackover are extremely poor, and the complication becomes readily apparent.

The other big complicating factor is that the reservoir rock itself is a chemical reef made up of oolitic and pisolitic limestone laid down as the upper member of the formation.



MAJOR FAULTING does not affect the overlying Cotton Valley formations. The concept of production on the north side of the regional graben has touched off an active exploration and drilling program aimed at finding new Smackover reserves Fig. 2.

Only where the ideal conditions of water temperature, composition, depth, and turbidity existed during deposition, is there a rock medium of sufficient porosity and permeability for commercial production. Incidentally, this is assuming that the rock has not been subjected to sufficient pressure, temperature, deformation, and chemical action, since deposition, to erase the porosity and permeability. Fortunately, this chemical reefing usually has taken place on and around the upthrown segments of the graben-faulted anticlines previously mentioned.

To date, the porosity and permeability factor has confined the major portion of Smackover exploration in North Louisiana to an area approximately 5 to 20 miles wide north and south and 95 miles long east and west. This is along the extreme northern portion of the state from Bossier Parish on the west to Union Parish on the east (see Fig. 1). The proved prospective area in North Louisiana is a narrow band extending along the northern boundary of the state from the north and east flanks of the Sabine uplift to the west flank of the Monroe uplift.

Following the discovery of Smackover production at North Lisbon field near the start of World War II, there was a long quiet period in Smackover exploration in North Louisiana. Then, in April 1946, came the first important discovery in this formation on the south flank of old Haynesville field in Claiborne Parish.

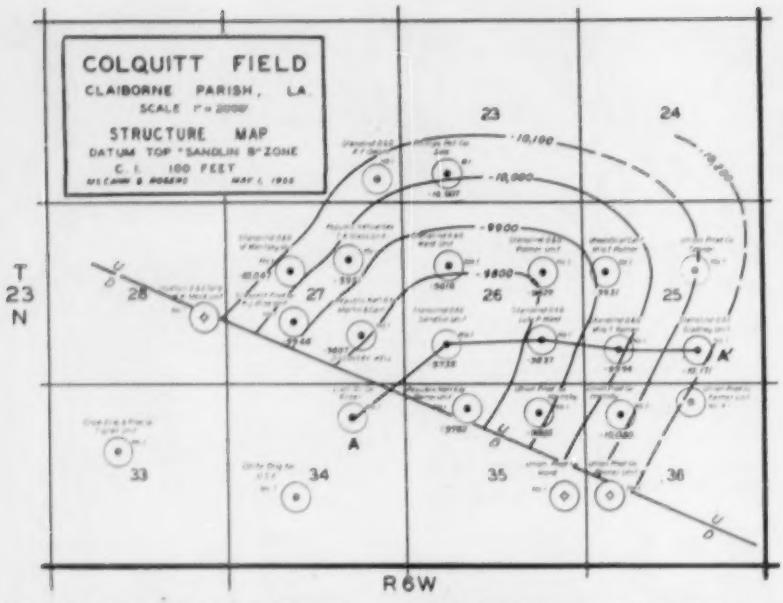
This followed several exploratory efforts atop the structure as reflected at shallower levels which, upon the discovery, were proved to be in a graben at Smackover level. This discovery set off an extensive lease play through Claiborne Parish and its environs. Development drilling for Smackover at Haynesville field was followed closely by discovery of like production at East Haynesville in October 1948. Of particular importance to current developments was the discovery of a relatively small area of Smackover production on the north side of the graben at East Haynesville in December 1949.

With the exception of development drilling at Haynesville and East Haynes-

THE AUTHOR

R. Lee Rogers is a consulting geologist with McCann & Rogers, Shreveport. He was graduated from University of Arkansas in 1948 with a B.S. degree in geology. He worked for Stanolind Oil & Gas Co. for 5 years in their Shreveport district exploration office. In 1953 he resigned from Stanolind to accept a position as district geologist with the Murphy Corp. at Shreveport. Rogers left this company in July 1955 to form a partnership with Wayne L. McCann, a petroleum engineer.

"The discovery of Colquitt field seemed to give the green light to North Louisiana Smackover exploration. Seven new Smackover fields or reservoirs have been found in the state in quick succession since, and drilling has been gratifyingly renewed in an eighth."



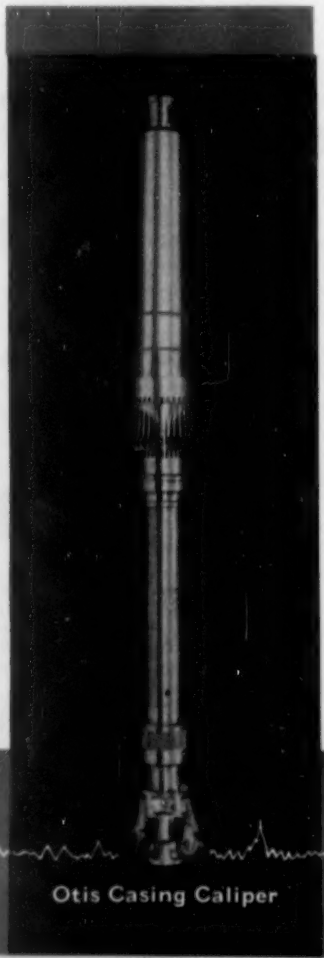
PRODUCTION AT COLQUITT is found on the north side of a graben. The Smackover producing zones occur at 10,000 to 10,500 ft. and the net thickness ranges from 10 ft. to about 95 ft. Fig. 3.

ville, the period 1948 to 1953 was dark and gloomy for North Louisiana Smackover production. Many wildcat wells were drilled, at an ever-slackening pace, with no exciting new discoveries, the only encouraging notes being that several shallower fields and reservoirs were discovered as a direct result of Smackover exploration, and ever-increasing subsurface data were being accumulated.

Most wildcats drilled were either in grabens at Smackover level, or lacked sufficient porosity and permeability, or were inconclusively cored or tested.

Colquitt discovery . . . Then, in 1953, the entire play was rejuvenated by the discovery of Colquitt field in Claiborne Parish. Drawing from previous unfortunate experience, the discovery well was deliberately located on the north flank of an untested seismic anomaly which showed up at Lower Cretaceous and Cotton Valley levels.

The discovery well was the Republic Natural Gas Co. 1 Martin-Cain Unit, SE 27-23n-6w, which was completed December 7, 1953, flowing 929 bbl. per day through a 16/64-in. tubing choke, flowing tubing pressure 2,850 psi., gravity 51.9°, gas-oil ratio 1,685:1, from approximately 10 ft. of net effective pay in the Smackover. As fate would have it, the first offset, located to the south and structurally higher on the shallower beds, was found to be in a graben at Smackover level; however, this test first proved that the field was definitely located on the north side of a graben. This well was completed in



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a shallower Cotton Valley sand found on the way down.

Now, 18 wells have been drilled to or for the Smackover at Colquitt field. There are two active locations, with one of these in the final completion stages. Of the 18 wells, 14 have produced from the Smackover and 4 have been dry in that formation.

Net effective pay, including the oolitic pay of the overlying Buckner member A zone, ranges from 10 to approximately 95 ft. in thickness. Well depths must range from 10,200 to 10,500 ft. in order adequately to test all possible pay. Dual completions are permitted from zones that are unquestionably separate reservoirs.

Combined potentials of dually completed wells range up to 1,000 bbl. per day on small chokes. Daily allowable, based on the standard Louisiana depth bracket, is currently 143 bbl. of oil per producing zone. Well spacing is on 160-acre voluntary units with each unit consisting of a governmental quarter section.

Wells usually take 4 months to drill and cost $100,000 to $150,000 for a dry hole or $200,000 to $250,000 for a producer. Primary reserves proved for the field to date are estimated at 6,000,000 bbl. Because the unusually high relative-volume factor of 2.6, preliminary steps for unitization of the field for a pressure-maintenance program have been already taken.

"The proved prospective area in North Louisiana is a narrow band extending along the northern boundary of the state from the north and east flanks of the Sabine uplift to the west flank of the Monroe uplift."

The discovery of Colquitt field seemed to give the green light to North Louisiana Smackover exploration. Seven new Smackover fields or reservoirs have been found in the state in quick succession since, and drilling has been gratifyingly renewed in an eighth. The discoveries were at Arkana, South Sarepta, Red Rock, Mount Sinai, Antioch, North Lisbon, and Bernice. Drilling has been renewed at the two-well marginal Summerfield pool with a fine new dual oil well just completed.

Colquitt field, along with Arkana, Northeast Haynesville, Mount Sinai, and Bernice, has not only renewed the interest of operators in old incompletely tested prospects, but has further focused their attention on the potentialities of the north sides of the grabens and also the possible extension of the prospective trend both to the east and west. From early 1955 to the present, a spirited lease play has been in progress through the trend in Bossier, Webster, Claiborne, and Union parishes and extending into the extreme southern portions of the neighboring counties of South Arkansas. Smackover exploration drilling is on the upswing, with a number of exploratory wells now being drilled and several already rumored or announced for early drilling.

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EXPLORATION

APPALACHIAN

EASTERN KENTUCKY

On Wolfe Creek in Martin County, E. C. Ware has completed 4 Roscoe Preece as a Mississippian Maxon sand producer. At a total depth of 1,476 ft. test pumped initially at the rate of 7 bbls. of oil daily.

OHIO

Indications of a gas pool in eastern Clark Township, Coshocton County, was found by Natol in a test on 1 Ethel Stewart, Section 19. White Clinton was topped at 3,541 ft. and at the last report, at 3,561 ft. the gas gaged 280,000 cu. ft.

● The Mid East 1 W. Busenburg, New Castle Township, Coshocton County, logged the Clinton at 2,981-3,038 ft. and made 368 bbl. in the first 24-hour test after Frac.

● In Flint Ridge field, Oxford Oil Co., 5 H. Kreager, Lot 11, Hopewell Township, Licking County, gaged 252 bbl. in a 24-hour after Fracing Clinton, found at 3,069-3,102 ft.

PENNSYLVANIA

Swan-Finch Brings in Natural-Gas Well

The Swan-Finch Oil Corp. has brought in a new natural-gas well in western Pennsylvania producing at an open-flow rate of 1,600,000 cu. ft. per day.

The well, 2 Farmers & Miners, is located in Indiana County's Bell Prospect which is on the Chestnut Ridge anticline. It was fractured at a depth of 7,500 ft.

In Brush Valley Township, Indiana County, Southwest Pennsylvania, Columbian Carbon Co., has started drilling operations in 1-1836 I. R. Smith wildcat, elevation 1,420 ft. It is on the New Florence Quadrangel 1.31 miles south of latitude 40 degrees 30 minutes and 1.25 miles west of longitude 79 degrees 00 minutes.

● Mount Pleasant Township, Westmoreland County, Peoples Natural Gas Co. 1-4092 J. G. Mailey shut down at 7,267 ft., to run the 7-in. casing. The tully was at 6,635 ft., Onondaga at 7,240 ft., and the Chert at 7,266 ft.

WEST VIRGINIA

Jumping Branch district, Summers County, West Virginia, Godfrey L. Cabot, Inc., announced 1-S-1457 Carl O. Lilly, elevation 2,353 ft., Big Bend Quadrangle, 3.12 miles south of latitude 37 degrees 40 minutes and 2.30 miles west of longitude 80 degrees 55 minutes.

● Union District, Preston County, Columbian Carbon Co. 1217 Theodore R. Rembold was dry after fracture, elevation 2,599 ft., Onondaga 5,471 ft., Chert 5,509-5,613 ft., show of gas, Orisdany sand 5,654 ft., TD 5,800 ft.

● Washington district, Upshur County, Washington Natural Gas Co. 1 Paul Shaw, elevation 2,075 ft., was completed dry at 4,240 ft.

HUGOTON EMBAYMENT

NORTHWEST OKLAHOMA

Hoover Pay Added To Hill Field Well

Sunray Mid-Continent Oil Co. added Hoover sand to the 1 Hill well in SE SE NW 6-25n-25w, South Laverne

THE OIL AND GAS JOURNAL

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field, Harper County. The well flowed 3,000 M.c.f. of gas per day on 30/64-in. choke from perforations at 4,346-64 ft. There was also 9 bbl. of fluid, mostly distillate. This well previously flowed distillate and gas from the Tonkawa sand at 5,638-70 ft.

The 1 Rambo well in the same field, NW NW SE 33-26n-25w, flowed 6,000 M.c.f. of gas per day after treatment of perforations in the Morrow sand at 7,128-45 ft. There were 65 bbl. of distillate and 15 bbl. of water on the flow through ½-in. choke.

TEXAS PANHANDLE

Outpost Well At Perryton Field Completed

A 1-mile north extension discovery to Perryton field in north-central Ochiltree County 2 miles southeast of Perryton, has been completed by Woodson Oil Co. The 1-C Perry Unit flowed at the rate of 2,600 M.c.f. of gas per day on ¾-in. choke from perforations in the Morrow sand at 7,792-7,902 ft. Location is in Section 1014, Block 43, H&TC Survey, 2 miles northwest of the 1-F Perry Unit, a shut-in gas well.

SOUTHWEST KANSAS

New Morrow Field Opened in Meade

Meade County has a new Morrow gas discovery at Shamrock Oil & Gas Co. 1 Langhofer, 18-33-30, 6 miles south of Plains, Kans. The discovery well flowed at the rate of 9,049 M.c.f. per day from perforations at 5,654-75 ft. Location is in the C NW SE of Section 18.

New Morrow Gas Pool Opened in Morton

Morton County in far southwestern Kansas has another Morrow gas-producing area as a result of J. M. Huber's

Another Morrow gas-producing area has been added to Morton County's producing column. Location is southeast of Sparks field and west of vast Hugoton gas field.

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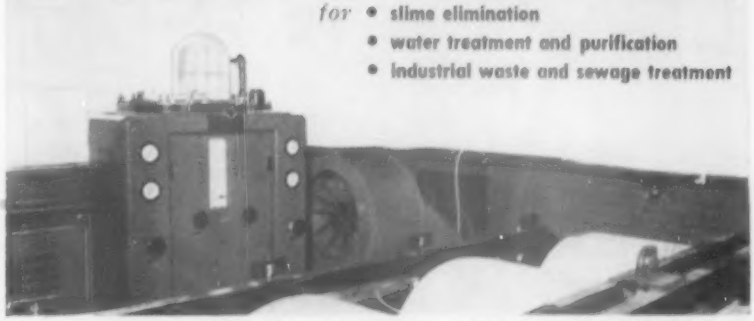

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success at his 1 Collingwood, C NE 11-31s-42w, 2 miles southeast of Sparks pool, and 6 miles northwest of Richfield.

The discovery flowed 1,300 M.c.f. of gas on drill-stem test at 5,192-5,235 ft.; recovery was 350 ft. gas-cut mud with 1,230 psi. bottom-hole pressure. A later test at 5,236-59 ft., open 1 hour, gaged 1,540 M.c.f. of gas and recovery included 300 ft. of gas-cut mud, 60 ft. of mud with some oil traces and 60 ft. muddy salt water.

WESTERN CANADA

ALBERTA

Bentley-Gilby Area Looks Big, Promising

All indications point to a definite trend building up between Joffre and the Gilby areas of central Alberta, north of Red Deer town. Recent oil discoveries from the Viking sand in the Bentley and West Gilby areas lie on the trend that begins at Joffre, extending northwestward for 43 miles. The widest point along the trend is about 2 miles at Joffre.

The discovery well of this light oil field was made on LSD 9, 19-38-25w4, in 1953. The discovery well was made by a group headed by Canadian Superior Oil Co. of California, Ltd. Since that discovery the Joffre area has grown into the second biggest Viking producer in Canada. The latest discovery was made at West Gilby by Hudson's Bay Oil & Gas Co., Ltd. The Bentley area has 10 Viking oil wells, Gilby has five.

Imperial Oil, Ltd., The California Standard Co., and Hudson's Bay have all made strikes in the trend. Imperial drilled stepout discoveries adding more productive area to Joffre field itself. These strikes were on its northwest end. The 5-5 Red Deer and 13-15 Burbank wells linked up West Joffre with Main Joffre field. The Burbank discovery is 4½ miles northwest of the extension to Joffre field at Red Deer 5-5.

The industry is anxiously watching the outcome of this Viking play at Joffre-Gilby-Bentley. Many more wells must be put down to really tell the story here. So far, only two failures have been drilled.

More D2 Zone Tested at Alix Wildcat

Canadian Gulf Oil Co.'s 9 McKibbon exploratory test in the Alix area

of central Alberta, reported last week as having found gas in substantial quantities in the D2 zone of the Devonian formation, this week opened up more of that zone and flowed oil to the surface from an interval immediate below the gas cap. The oil zone has now been fully penetrated and hole was carried down to the D3 zone (where salt water was encountered). Crew is currently running a set of logs at total depth before attempting completion operations.

The well is being drilled on LSD 9, 6-40-23w4, 4 miles southeast of Clive Devonian oil production and the same distance west of the nearest gas completion in Nevis field.

Initially reported drill-stem test at the well (reported last week) bottomed at 6,035 ft. flowed gas at maximum rate 4,025,000 cu. ft. daily. Pipe recovery was 165 ft. of oil and 20 ft. of salt water. Next test in the discovery horizon, of the interval 6,034.5 to 6,045 ft. gave a good initial puff, followed by a maximum daily gas blow of 1,000,000 cu. ft. The gas flow died in 30 minutes and oil reached the surface in 42 minutes. Flow rate was measured at 13 bbl. the first hour the valve was open and 12 bbl. during the next hour. When pipe was pulled it contained 1,183 ft. of oil, with no evidence of formation water.

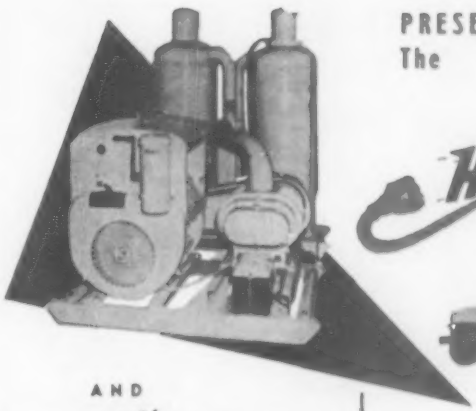
SASKATCHEWAN

Imperial Oil Limited's extensive exploration program in southeast Saskatchewan is paying off with an amazing success-failure ratio. It was reported during the past week that another pair of wildcat tests in that sector of Canada had indicated oil production from the Mississippian formation. One of the ventures reported lies in the Gainsborough area, 11 miles southeast of the Ingoldsby oilfield while the other, in the Kingsford area, lies 1½ miles north of oil production.

The Gainsborough test, Imperial-Gainsborough No. 7-19, on LSD 7, 19-2-30w1, found its zone in the Mission Canyon sector of that formation while the other, Imperial-Kingsford No. 7-21 tested the Charles zone for its commercial prospect.

Four drill-stem tests were run in the Mission Canyon at the Gainsborough and all but the last gave up water-free oil recoveries. The zone was encountered around the 3,509 ft. mark and best drill-stem test run gave up 1,200 ft. of clean oil.

At the Kingsford well, five tests were completed in the Charles horizon encountered at 4,612 ft. and all but one, the initial test in the zone, also gave up water-free oil recoveries.



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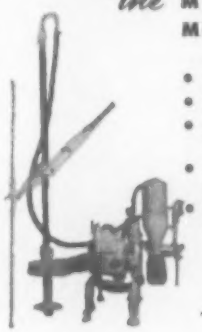

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Pacific Coast exploratory and development activity during the first 6 months of 1956 saw the drill in action in 11 scattered areas, particularly in and around older producing areas.

First half shows expansion as

Offshore Tests Share Interest In California Exploration

by Bill Smith

EXPLORATORY activity in California the first 6 months of 1956 was highlighted by slightly expanded offshore work and the continued success of deeper drilling around known producing structures.

Los Angeles Basin . . . Topping the list in the latter type of drilling was General Petroleum Corp.'s discovery in 37-year-old Santa Fe Springs field.

Already boasting production at one time or another from eight different zones during its lifetime, General Petroleum added a ninth last February with completion of the 9,010-ft. 243 Santa Fe. It was brought in flowing 1,776 bbl. daily of 30.9°-gravity crude. Prior to this discovery, deepest production in the field was at 7,950 ft. The producing interval of G.P.'s discovery is 8,050-9,010 ft.

This strike immediately touched off a drilling boom in the old field. An average of 20 rigs have been busy there either redrilling old producers or sinking new wells. Since the discovery, wells have been completed in the new Santa Fe zone for initial production rates varying between a peak of 1,800 and a low of 125 bbl. daily.

Other significant discoveries in the basin include strikes at Redondo Beach, Bandini, Dominguez, and Honor Rancho.

Redondo Beach . . . Late last year the voters of the ocean city of Redondo Beach approved a drilling program between the city and three oil companies with Signal Oil & Gas Co. as operator. Under terms of the agreement, Signal was to drill six wells from an onshore site with any future wells being drilled from an offshore structure.

The first test drilled by Signal encountered frequent shows en route to total depth of 4,036 ft. It was completed last April in a zone at 2,850-3,098 ft. flowing 172 bbl. daily of 26°-gravity crude through a 20/64-in. choke. The producing zone corresponds with the main pool of Torrance field which is developed from onshore wells. However, because Signal's production is coming from a bottom hole nearly 3,000 ft. from the nearest Torrance field onshore well, it was considered a new-pool discovery. Since that time, Signal has completed one development well in the new pool and was drilling ahead on a third.

Bandini field . . . Operators found two new Pliocene-age pools in Bandini field in East Los Angeles. Richfield Oil Corp. hit the North O'Connell pool January 23 with A-2 Southside drilled on the north side of a north-south-trending fault in the field. It flowed 488 bbl. daily of 37.7°-gravity crude from 7,089-7,148 ft.

On the south flank of the field, General Exploration Co. of California tapped Meyer pool for a discovery at 4,920-5,020 ft. Initial production was 326 bbl. daily of 42.5°-gravity crude through a 14/64-in. choke.

Dominguez discovery . . . Dominguez field in South Los Angeles yielded a new major-pool discovery when Union Oil Co. brought in a Miocene producer in a new pool in the northwest block of the field. This well offset (but produced from a greater depth) a discovery scored by J. K. Wadley in the same area last year. Union's test flowed 797 bbl. of 30°-gravity crude initially through a 34/64-in. choke from 7,435-8,269 ft.

Honor Rancho . . . Another extension test in Los Angeles County which attracted considerable attention was The Texas Co.'s 13 Honor Rancho A. This well was completed as a new-pool discovery more than ¾ mile southeast of the main producing area. The well flowed 1,065 bbl. daily of 37.7°-gravity crude from 8,900 ft. Deepest producer in the field's main area is about 6,600 ft.

San Joaquin Valley . . . Exploratory successes in this area were marked by another new pool discovery by Richfield at Wheeler Ridge and the further development of the Strand field.

Richfield completed 52-36 KCL-F last March for a new Miocene pool discovery in the Windgap area more than 2 miles southeast of the main Wheeler Ridge field. Some of the sparkle was rubbed off this new find recently when the first offset was abandoned as dry after being taken more than 1,000 ft. deeper than the discovery. This discovery well was completed at 8,950 ft.

Strand activity . . . In the Posuncula area of Strand field near Bakersfield, extension test drilling by three major companies resulted in significant completions in both the Vedder and Stevens zones.

Shell Oil Co. last March completed

the 12,505-ft. 134-1 Posuncula-KCL to extend Vedder production more than ¼ mile west. In late May, Shell again extended Vedder production, this time ¼ mile east with completion of 111-7 Shell-TWA-KCL at 12,440-52 ft.

Union reached out more than a mile north of the Posuncula area in May to get a Stevens zone producer. And, during the same week as Union's successful Stevens well north of the nearest Stevens producer, Tidewater Oil Co. redrilled an old well on the south flank of the area to tap the basal Strawn at 9,530 ft.

Coastal region . . . The big news in this part of California has been the development of Bridge pool in South Mountain field, Ventura County. Also, as was forecast at the beginning of the year, the search for Sespe production in the Santa Clara Valley region has been stepped up.

Bridge pool . . . Texaco touched off the drilling action at the first of the year with completion of 1 Richardson-Earl for a new-pool discovery near Willard Bridge, a prominent and well-known landmark in the region. Following the discovery, two development wells, one a north offset and the other an east offset, were complete as far better producers than the discovery.

With just the discovery and the two offsets, it is already being hailed as probably the hottest exploratory area in the state.

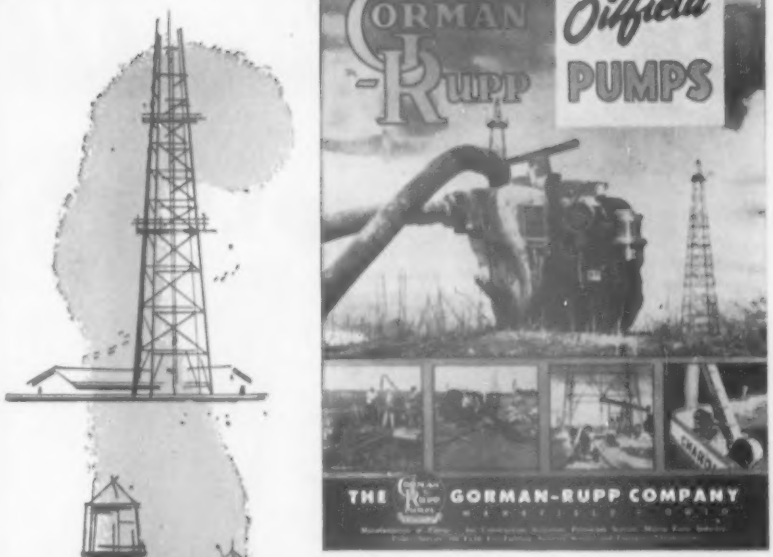
The discovery was completed on the pump for 75 bbl. daily. The west and north offsets were completed flowing 925 and 821 bbl. daily, respectively.

Sespe search . . . So far this year, the deep-drilling search for Sespe production in the Santa Clara Valley hasn't turned up any significant finds. However, there were a number of wells still drilling which were being closely watched.

Most of this action centered around the town of Oxnard. Here Richfield was drilling three different wildcats aimed at the Sespe. Two were seeking production within the town's city limits while the third was being drilled near the airport. Judging from early tests on the wildcat drilling near the south edge of town, the operator appeared about ready to abandon the project at 12,144 ft.

Another interesting wildcat in the Valley was Western Gulf Oil Co.'s Point Magu project. This well, 1 Union-Laubacher, was drilling ahead at 11,380 ft.

Inland from Oxnard, both Standard



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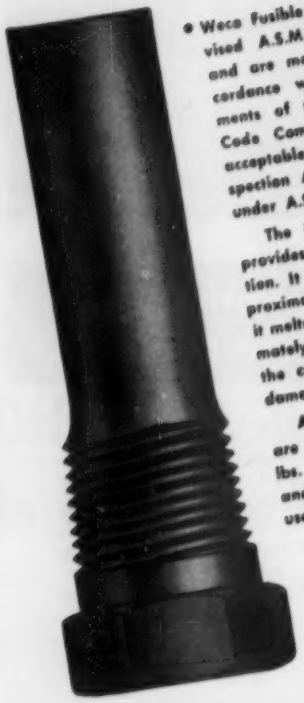

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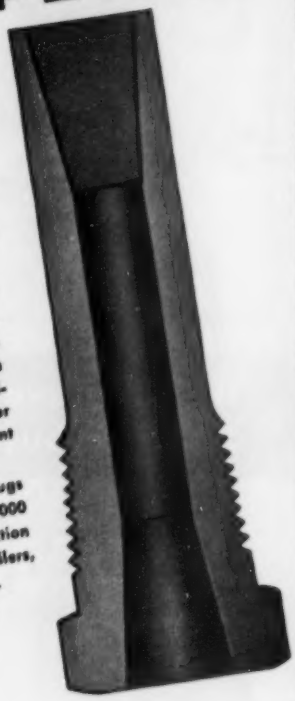

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1" x 3"	1083	13 oz.
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*1¼" Thread length

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Oil Co. of California and Humble Oil & Refining Co. were drilling ahead on deep tests near Fillmore. Standard already has production in the area, about 2½ miles west of town. Standard's latest try was drilling ahead below 13,750 ft. on a site near 6 Sespe, the operator's most recent successful well there which was completed at 14,050-14,180 ft.

Humble's wildcat was drilling below 11,587 ft. It is located about ½ mile northeast of Standard's test.

PACIFIC COAST

CALIFORNIA

Texaco to Deepen Bridge Discovery

The Texas Co. was moving in equipment to deepen its Bridge pool discovery well in South Mountain field, Ventura County. Texas engineers hope to recomplete this well at a production figure near to that of the two offsets which were drilled after the discovery. The discovery, 1 Richardson-Earl, was put on the pump for 250 bbl. daily after a Sandfrac job. It's producing interval is 7,211-7,720 ft. The east offset was completed at 7,375-8,050 ft. for 952 bbl. daily and the north offset was brought in flowing 821 bbl. from 6,497-8,100 ft.

Tidewater Nears New Field Find

Tidewater Oil Co. was nearing a possible new field discovery with 2 Orton in the Corral De Quati area of Santa Barbara County. The operator was preparing to put the wildcat, located 10 miles north of Capitan field, on the pump for completion. It was originally drilled to 6,185 ft. and then plugged back and redrilled to 5,900 ft.

Richfield Abandons First Orchard Test

Richfield Oil Corp. has abandoned 1 Richfield-Standard-Ruggles, the first test for production from within the Oxnard city limits in Ventura County. This test, which was slant-drilled under city property from a site on the south edge of town, was taken to 12,144 ft. before the decision was made to abandon it. Richfield was aiming at the Sespe, the source of prolific production both to the west and east of town.

WHAT USERS SAY about Bucyrus-Erie Spudders

MICHIGAN, OPERATOR, 28-L: "Nicest rig I ever worked on . . . Bucyrus spudders really cut the hole and stand up well. They're easy to handle, too."

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PENNSYLVANIA, OWNER, 60-L: "Past record of our 28-L sold us on the 60-L before we even used it."

COLORADO, OWNER, 48-L: "Last word in drilling with cable tools."

These are actual quotes from users* of Bucyrus-Erie spudders on various drilling contracts throughout the country. In state after state, these experienced oil well contractors and operators say basically this: "We recognize the value of Bucyrus-Erie's close attention — during manufacture — to all the things that assure outstanding quality. The resultant fine performance, long-life construction, easy operation, mobility, and dependability of these spudders are the things that put the extra profits in our contracts."

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FIRST with the FINEST in Spudders

More on the Crane Trend

By Robert L. Breedlove*

AN unusual thing for the Ark-La-Tex area is that the 44 miles of the Crane Trend from the Longstreet end of the trend to the west end of the South Hallsville tongue is in a relatively straight line except for a very gentle 7-mile curve starting west of De Berry. The total mileage of the three tongues and the main body of the Crane Trend exceeds 67 miles of continuous reservoir and the four ends are not yet definitely defined.

Subsea points and intervals . . . The lowest subsea point in a Crane lime producer on the entire trend is minus 6,690 ft. on top of the Crane lime in Lyons & Logan 1 Loftis at the west end of the South Hallsville tongue. However, this end and the west end of the Beckville-Tatum tongue have the thinnest interval from the base of the Massive anhydrite to the top of the Sligo of any place on the whole trend.

The highest subsea point on the Crane Trend is minus 5,403 ft. on the top of the Crane lime in Union Producing Co. 1 Lewis, 2 miles southeast of De Berry, approximately three-fifths of the way from the western to the southeastern end of the trend. This is 1,296 ft. higher than the lowest point and 651 ft. higher than the southeast end of the trend, which is minus 6,054 ft. on top of the Crane lime in Mid-Century A-1 Talbert. The difference between the southeastern point and the lowest point on the western end of the Crane Trend is 645 ft.

No salt water has been encountered to date, which is interesting after noting these differences in structural points.

Trend widths . . . The greatest width of productive area of the Crane Trend is over 4½ miles and occurs in Louisiana. The narrowest width is about 1 mile at three places on the trend; at both western ends of the two western tongues and again where these tongues divide in the trend.

An unusually constant width averaging 2½ miles stretches for 11 miles from the state line northwest beyond De Berry.

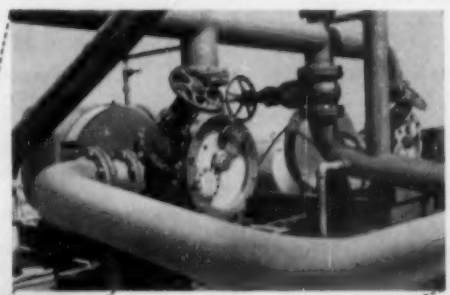
Pertinent data . . . For the 7-8 mile area from the Texas line east to Longstreet, La., the highest number of millidarcies for any 1-ft. interval is 508 and the highest porosity is 29.5 per cent. Four and five consecutive feet having permeability averaging 350 md. per foot and over 24 per cent porosity each, have been cored here. However, the average for 14 wells is 53 md. per foot and 18.5 per cent porosity.

In the South Hallsville tongue, most potentials vary from 27,000,000 to 70,000,000 cu. ft. of gas per day. The few smaller potentials are usually at the west end of the tongue. The highest calculated open flow for the Crane Trend was 290,000,000 cu. ft. of gas per day plus 54.8 bbl. of distillate per million from Latex 1 Wyatt. This was out of 6½ ft. of MicroLog porosity that had an average permeability of 53 md. and a porosity of 21 per cent.

Acid treatment . . . Today on the Crane Trend, most treatments are from 6,000 to 8,500 gal. of acid. Few treatments have ever been less than 4,000 gal. The heaviest treatments recorded were 20,000 gal. in Imperial 1 J. Roberson and 16,000 gal. in Latex 3 Geisler. The 1 Roberson is nearly 5 miles west of De Berry and is where the trend begins to narrow going west. The Roberson had an initial potential of 11,500,000 cu. ft. (actual open flow) and a rock pressure of 2,542 psi. The Latex 3 Geisler is 3½ miles west of the east end of the South Hallsville tongue, where it is about 1 mile wide. The Geisler had an initial potential of 45,000.000 cu. ft. per day with a shut-in pressure of 2,732 psi. and a flowing tubing pressure of 2,300 psi.

*For a full account of this important producing trend in East Texas and Louisiana, read "That Crane Trend" on page 103 of the June 18 issue of The Oil and Gas Journal.

MILLION-GALLON WEEK-ENDS...



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GREAT LAKES

MICHIGAN

After testing second Traverse zone (Alpena) dry, C. W. Collin plugged back and was completing his 1 Sipka, NW SW SE 14-9n-1w, Elba Township, Gratiot County, in the Squaw Bay Traverse where well flowed an estimated 250 bbl. of oil a day when pay was first drilled. This semi-outpost just east of the Elba pool (producing from Squaw Bay) has been flowing about 100-150 bbl. of oil a day through 5-in. casing since plug-back. Well flowed as much as 300 bbl. immediately after cement plug was drilled and hole was swabbed three times. Top of Traverse lime was logged at 2,430 ft. Pay way drilled at 2,431-34 ft. Alpena section was drilled out dry at 2,539 ft. Hole carried 300 ft. of water in 2 hours between 2,534-39 ft. Hole was plugged back to 2,528 ft.

The Squaw Bay Traverse pay encountered in Michigan wells has been a flashy, but not too prolific producing horizon.

MID-CONTINENT

NORTH TEXAS

Coleman County Gets New Gardner Sand Pool

Utex Exploration Co. 1 Cook, Coleman County wildcat 7 miles northwest of Valera, in Section 32, Block 1, GH&H Survey, flowed 75 bbl. of oil a day on completion test.

After setting pipe to 3,384 ft., perforations were made in the sand at 3,315-18 ft. Production was through 26/64-in. choke, tubing pressure was 220 psi. Gas oil ratio was not reported.

The well also had oil and gas shows in drill-stem tests of the upper Capps limestone at 3,001-20, and in Morris sand at 3,086-92 ft.

Gardner flow in Shackelford . . . Geochemical Surveys, Inc. 1 Davis, southeastern Shackelford County wildcat, flowed oil on a drill-stem test of the upper Gardner. On initial test at 3,902-14 ft., gas surfaced in 30 seconds, spraying mud in 33 minutes and distillate in 70 minutes, with an estimated 2,000 M.c.f. of gas per day. Flowing pressure read 1,020 psi.

The oil flow came on test at 3,914-24 ft. Oil reached the surface in 7 minutes but rate of flow was not estimated. Location is in Section 45, Block 13, T&P Survey.

OKLAHOMA

Third Pay Added To Kingfisher Field

Mississipian oil pay has been added to Big Chief Drilling Co. and Nuckolls-Bell Drilling Co. 1 Ted Oltmanns, NE NE NW 25-18n-5w, new Kingfisher County discovery in north-central Oklahoma.

Circulation was lost just above total depth of 6,223 ft. No drill-stem test was made in the zone. Later the well flowed 77 bbl. in 30 minutes. The Mississippian is a second pay zone for this well, and the third for the new field. The Oswego lime flowed oil at 5,942-67 ft. The discovery well, ¾ mile northeast of the Oltmanns, flowed oil from the lower Layton, and gas from the Skinner.

East Nellie Extended

Schafer Drilling Co. 1 Nunnelly, C NW NW 8-1n-8w, Stephens County, has extended East Nellie field to the south. The well flowed 96 bbl. of oil in 9 hours on ¾-in. choke from perforations at 3,599-3,611 ft.

WEST CENTRAL TEXAS

Fisher County Prospect Makes Flow Test

General Crude Oil Co. 1 Joe Dooley, Ellenburger prospect 5 miles west of Claytonville, flowed 90 bbl. of oil in 22 hours through 16/64-in. choke on its initial flow test. Production was from perforations at 7,230-60 ft. Location is in 171-3-H&TC.

Union Oil and General Crude 1-177 Kate Davenport was coring ahead after recovering Strawn oil shows on drill-stem test at 6,550-82 ft. Recovery in 1 hour was 120 ft. of mud and 30 ft. of slightly gas-cut mud having a scum of oil on top. Location is 3 miles northwest of Claytonville in 177-3-H&TC.

Fox & Ransdell 1 Turner ran a 3-hour test in Strawn at 5,357-65 ft., which flowed some gas and recovered 45 ft. of oil. A second test, at 5,365-90 ft., had gas in drill pipe and recovered 30 ft. of heavily oil-cut mud. Location is in Elijah Bell Survey 328.

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ROCKY MOUNTAIN

MONTANA

Dual Completion Planned At Piper Discovery

A Piper and Amsden oil discovery at Wolf Springs field, Yellowstone County, will be dually completed, according to Atlantic Refining Co. The 13-2 Horton estate, C SE NE 13-7n-31e, flowed oil at the rate of 113 bbl. of oil per day on 1-in. choke from the Piper lime at 5,981-96 ft. and the Amsden at 6,030-66 ft. The Piper is a new pay for the Amsden area.

New Pay Reported At Ivanhoe Dome Well

A new pay sand is in line for Ivanhoe, Musselshell County. Gulf Oil Corp. 1 De Jaegher, C NW NW 21-11n-31e, recovered 2,807 ft. of free oil on drill-stem test of a sand at 3,910-65 ft. This sand is above the discovery well's pay. The discovery well here is R. P. Oliver 3 State, C SW SW 16-11n-31e, a 235-bb. per day well from 3,964-78 ft., a Amsden - Heath transition zone discovery.

COLORADO

New Pay Discovery At Canadian River Finaled

The Canadian River discovery, Cabeen Exploration Co. 1 Blevins in Jackson County, North Park basin, has a new pay. The 2 Blevins, NW SE SE 3-9n-78w, flowed 21,000 M.c.f. of gas per day from Dakota and Lakota perforations. The discovery well of this new field in northern Colorado flowed 6,000 M.c.f. of gas per day from the Muddy sand. Another well is drilling in the area, the 1-B Blevins, NW SE NW 3-9n-78w.

SOUTH LOUISIANA

SOUTH LOUISIANA

Coffee Bay Oil Field Gets Gas-Condensate Producer

Olin Gas Transmission Corp. is making a gas-condensate producer in its 5 Grandison, in the Coffee Bay area, Lafourche Parish. The field's two previously completed wells are oil producers, one at 11,400 ft. and the other at 10,085 ft. The new well is perforated at 9,904-07 ft.

Production had not been gaged as this is written, but flowed with pressure of 2,900 psi. through ¼-in. choke. Shut-in pressure is 3,200 psi.

The well has been standing since last April with stuck drill pipe. Operators recently went back in the hole, cleaned out to 11,000 ft., and then plugged back to the 9,900-ft. gas-condensate sand.

Plaquemines Parish Gets Another New Oil Discovery

Richardson & Bass have another new oil discovery in Plaquemines Parish. Discovery well is their 2 Humble-Continental State Lease 2513, south of the Pointe-a-la-Hache area, 25 miles down the Mississippi River from New Orleans.

Testing Miocene sand, perforated at 10,758-65 ft., the well flowed at an estimated rate of 99 bbl. of 25.6°-gravity oil with 170,000 cu. ft. of gas per day through 17/64-in. choke. Gas-oil ratio figured 1,700 cu. ft. per barrel with flowing pressure of 1,450 psi.

The well had been drilled to 11,500 ft. and has casing cemented on bottom.

HEAD OF THEIR CLASS

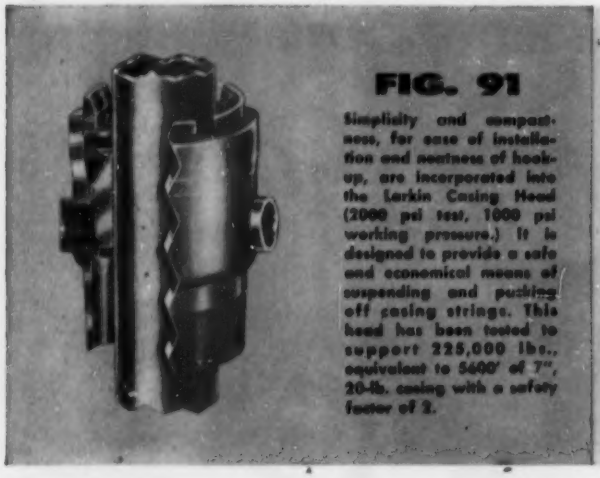
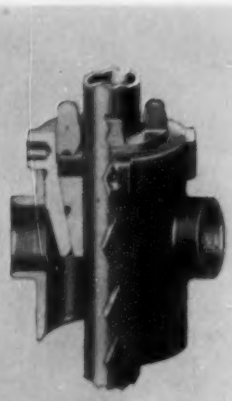


FIG. 91

Simplicity and compactness, for ease of installation and neatness of hook-up, are incorporated into the Larkin Casing Head (2000 psi test, 1000 psi working pressure.) It is designed to provide a safe and economical means of suspending and pulling off casing strings. This head has been tested to support 225,000 lbs., equivalent to 5600' of 7", 20-lb. casing with a safety factor of 2.



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LARKIN LEADERSHIP HAS BEEN EARNED

SOUTH TEXAS

SOUTHWEST TEXAS

Deep Hagis Ranch Wildcat Rates Large Wet-Gas Flow

Atlantic Refining Co.'s deep wildcat test in Hagist Ranch field, northern Duval, has been completed with an absolute open-flow gage of 100,000,000 cu. ft. of wet gas per day. It has a gas-liquid ratio of 50,000 cu. ft. per barrel, gravity of the liquid being 50°. Shut-in pressure is 4,416 psi.

The well, 40 Foster, is one of the largest ever completed in the general area. Production is from perforations at 9,644-66 ft. Hole was drilled to 10,107 ft. and plugged back to 9,705 ft.

Jim Wells County Wildcat Indicates New Oil Strike

Preliminary testing at Tidewater Oil Co.'s 2 Freeborn trustee, wildcat in northern Jim Wells County, 20 miles north of Alice, indicates the discovery of another new Frio-Vicksburg field.

The well flowed 13.9 bbl. of oil during a 16-hour gage through 9/64-in. choke, with pressure of 200 psi. During a later 11-hour gage, through ⅛-in. choke, it flowed at the rate of 25.44 bbl. per day with pressure up to 450 psi.

Pay interval is perforated at 5,501-05 ft. Testing continues. Location is about 2 miles south of Southwest Ramerina field, on the Jim Wells-Live Oak county line.

UPPER TEXAS COAST

Clodine Wildcat Extends Field Into Harris County

Production of Clodine field, in northeastern Fort Bend County, is being extended a mile northeast into Harris County.

The extension is by Bradco Oil & Gas Co. at its 1 Williams, in the John Brock Survey. Testing casing perforations at 7,348-56 ft., the well flowed 120 bbl. of 42°-gravity oil per day through 5/32-in. choke. Flowing pressure gaged 2,250 psi. and gas-oil ratio 7,250 cu. ft. per barrel. Total depth is 8,370 ft.

Operators are continuing tests before completing the well.

Testing also is getting under way at Stanolind Oil Co. of Texas' confirmation well in the Northeast Clodine area, about 1½ miles farther northeast, in Harris County. This well, 1 Brubaker, 2,350 ft. southwest of Standard's discovery well, productive of gas and condensate, is an indicated producer, but had not been gaged as this is written. It is perforated at 7,718-24 ft. in the discovery well's pay.

Deep Discovery Uncovers New Jasper County Field

Gulf Oil Corp. has a new oil-discovery well in southwestern Jasper County where its 1-H Hankamer, in the Jacob H. Garner Survey, flowed at the rate of 193 bbl. of 44.3°-gravity oil per day through 3/16-in. choke while testing Wilcox perforations at 10,958-11,000 ft.

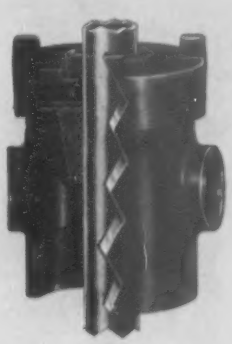
The discovery is about 8 miles west and a little south of Buna, and about 4 miles from production in Buna field. It is about the same distance southeast of production in the Silsbee area, in northeastern Hardin County.

The well had been drilled to 12,000 ft. Its flow was under perssure of 900 psi. Gas-oil ratio was 6,684 cu. ft. per barrel.

for medium pressure wells

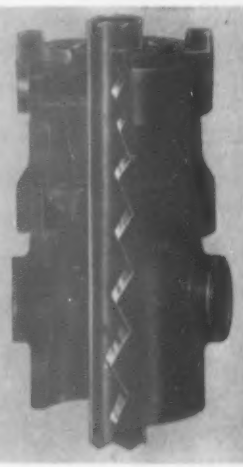
TYPE R

The Larkin Type R. Tubing Head is a conversion from the Type SR Head. This ease of conversion makes it possible to use the same stripper adapter and Neoprene stripper when working on any well equipped with a Larkin Tubing Head.



TYPE SR

The Larkin Type SR Tubing Head is a slip suspension head, equipped with a Neoprene Stripper which serves as a blow-out preventer and oil saver while tubing is being pulled or run. It is very suitable where higher pressures might be encountered.



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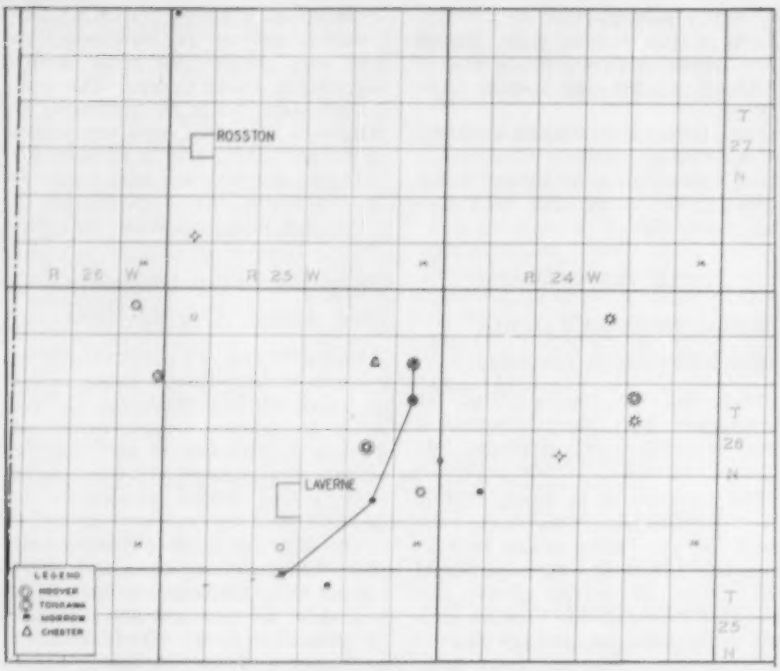


FOUR SEPARATE PAY ZONES point up the importance of the Laverne area. Fig. 1

The lower Tonkawa sand appears to be fairly continuous in the Laverne area. However, wells have produced gas at lower subsea elevations than wells producing oil from the same stratigraphic horizon. This strongly indicates that the reservoirs in the lower Tonkawa may not be connected.

Morrow sands are present in the interval just above the Pennsylvanian-Mississippian unconformity. Several sands are present and produce, although the net sand thickness varies considerably from well to well.

Sands of Chester age are the deepest producers to date. Cities Service Oil Co. and Gulf Oil Corp. dually completed the 1-A McLung (Section 11-26n-25w) from the lower Tonkawa and the Chester sands (well 3). The latter zone had a calculated open flow potential of 100,000 M.c.f. gas per day.

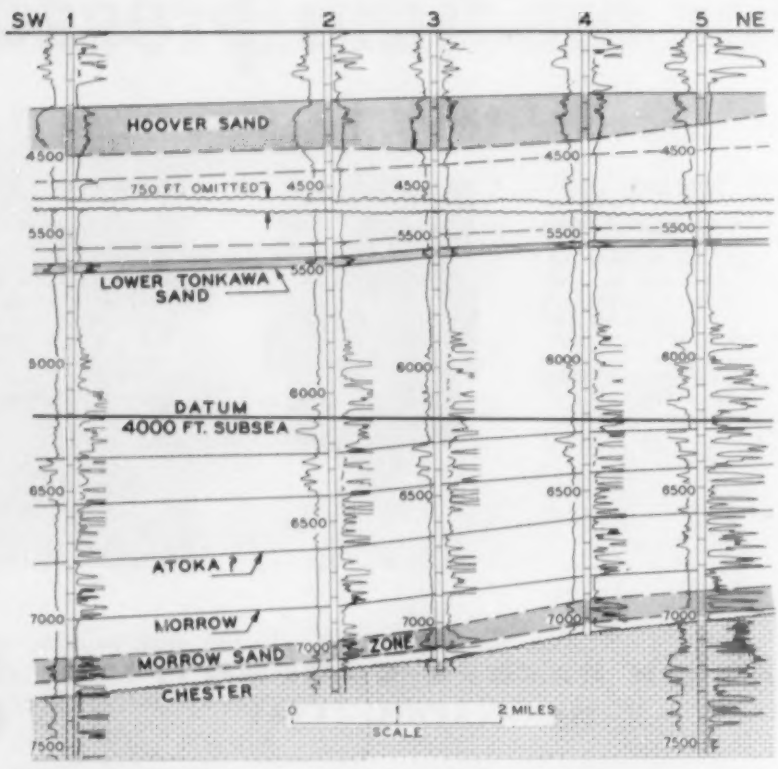
A study of Township 25w shows success of the current drilling campaign. Seven successful completions with no dry holes—and all of these wells are considered exploratory tests! Lack of a pipeline outlet is probably the biggest deterrent to rapid development of the Harper County gas reserves.

Gas Reserves Increase in New Harper County Field

by Norman S. Morrisey
Drilling-Development Editor

EXPLORATORY drilling in the Laverne area of Harper County, Oklahoma, has enjoyed a phenomonal success record. Four, separate pay zones above 7,500 ft. make Laverne an important new gas area for Oklahoma. Initial potentials of 100 million cubic feet of gas per day are not uncommon, and several of the wells have been completed dually.

Production is from the Hoover, Tonkawa, Morrow, and Chester sands (see Fig. 1). Shallowest is the Hoover that occurs at drilling depths of 4,200-4,400 ft. This sand is 150 ft. thick locally, although usually only the upper part of the sand is productive. The lower part carries salt water. Magnolia Petroleum Co. logged 100 ft. of broken MicroLog pay in the Hoover in their 1 Stinson. On a drill-stem test of the upper part of the sand, the well tested 3.5 million cubic feet of gas per day. (See well 5 on cross-section). An-Son Petroleum Co. dually completed its 1 Laverty (see well 2 on cross-section) from the Hoover and the Morrow sands. The Hoover zone had an initial potential of 11 million cubic feet of gas per day plus 44 bbl. of distillate.



PRODUCING HORIZONS are the Hoover, lower Tonkawa, and Morrow sands and the Chester. Fig. 2.

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He follows his own advice . . .

. . . Conoco's Perlitz A Busy Man

CHARLES A. PERLITZ, JR., is a young man as top echelon oil executives go. He tries to stay that way by spending much time working with youngsters and counseling them.

When a boy comes to him for advice, he has one answer: "Keep busy each hour of the working day—the future will take care of itself."

That reveals much about 53-year-old Charlie Perlitz. He's a busy man, who's going to be even busier. He's just stepped into the No. 2 job at Continental Oil Co. as executive vice president.

Left the law . . . Perlitz is a trained lawyer. He received his bachelor of arts degree from Georgetown University in 1925 and his law degree from Harvard in 1928.

He served with a prominent Houston, Tex., law firm for 9 years. Then he became intimately acquainted with the oil business by spending 7 years with Strake Petroleum, Inc., a highly successful independent Houston oil firm. He left Strake 10 years ago to join Continental.

Before his first year with Conoco was up, Perlitz was elected a vice president, and in the following year, 1947, was elected a director and acclaimed as one of America's youngest executives of a major oil company. He was elected senior vice president in 1953 following service in several operating departments.

Eye on youth . . . This quiet-mannered, friendly individual has an interest in youth that is more than passive.

He's an active supporter of Junior Achievement work projects, among others. He feels J.A. is a great thing for young people and grounds them in the principles of the capitalistic system. He believes education is one of youth's finest assets and urges the coming generation to get as much training as possible.

Perlitz' interest in civic accomplishments led to his election as first president of the Junior Chamber of Commerce in Houston, back when it was organized in 1930. This organization, incidentally, flourished to become one of the largest Jaycee groups in the country.

Keeping busy these days is the least of Perlitz' worries, for in addition to his regular duties—now increased—he's a director of Great Lakes Pipe Line Co.; Hudson's Bay Oil & Gas Co., Ltd.; Petroleum Chemicals, Inc.; Sahara Petroleum Co.; Continental Oil Co. of Libya and the Texas National Bank Building Co. These are all Conoco subsidiary or affiliated companies.

He is also a director of Bank of the Southwest; Texas Fund, Inc.; Houston Farms Development Co.; J. A. Walsh & Co.; and Gearench Manufacturing Co.

Professional memberships include I.P.A.A., A.P.I., Texas Mid-Continent Oil and Gas Association, and national, state and local bar associations. He is also a director of the Houston-Harris County chapter of the American Red Cross.

Likes sports . . . Perlitz is an avid hunter, preferring to go after duck and quail, and is proud of his latest membership—in the Eagle Lake Rod and Gun Club.

Golf also rates high on his list and he plays with a handicap of nine. He's been playing the game since he was 16. Tennis is a fine game, he says, but you're so busy hitting the ball its hard to enjoy the company.

R. Scott Graham, formerly with Creole Petroleum Corp. and Carter Oil Co. as a production and reservoir engineer, is now associated with John S. Herold, Inc., petroleum geologists and consultants, New York.

Bruce K. Brown, president of Pan-Am Southern Corp., has been named president of Petroleum Chemicals, Inc. He will join Petroleum Chemicals later in the year when Pan-Am Southern is merged with American Oil Co.

J. S. Leach, chairman of the board of The Texas Co., will retire from active service October 1 upon completion

A. C. LONG

J. W. FOLEY

of 40 years in the Texaco organization. He will continue as a member of the board of directors. **Augustus C. Long,** president of the company since 1953, has been elected chairman and chief executive officer, effective October 1. **James W. Foley,** executive vice president since 1955, will succeed Long as president.

Robert W. Pack, director of production for Sun Oil Co. and a director of the company, will retire August 1 after 39 years with Sun. Pack joined Sun in 1917 as a geologist. In 1920 he was made general manager of the Gulf Coast division and was elected vice president and general manager of Sun Pipe Line Co. He was named a director of Sun Oil and made director of production in 1947.

Personals

Frazer Bailey of San Francisco has been elected a director of Merchants Petroleum Co., succeeding **George Wickham,** who has retired.

E. J. GALLAGHER

E. J. Gallagher, formerly production manager of Canadian Gulf Oil Co.'s operations in Calgary, has been appointed assistant general manager of British American Oil Co. Ltd.'s production department in Calgary. Also appointed to B-A production posts in Calgary are **L. G. May,** formerly assistant production manager for Canadian Gulf, as production manager; and **O. W. Wall,** formerly manager of British American's production operations in Calgary, as assistant production manager of the company's enlarged operations. **J. H. Manning,** formerly manager of exploration for British American in Calgary, has been made zone exploration manager for Saskatchewan and Manitoba with headquarters in Regina.

Frederick R. Palin, Chatham, Ont., assistant general manager, secretary and treasurer of Union Gas Co. of Canada, Ltd., has been elected president of the Canadian Gas Association.

H. F. Tomfohrde, Jr., has been appointed manager of the newly created lubricants supply department of Tidewater Oil Co.'s eastern division. Tomfohrde has been assistant to the manufacturing department vice president since 1950 and assistant to the eastern division general manager since 1954.

Philip Ver Planck, Jr., Pacific Lighting Gas Supply Co., has been elected president of the Southern California Meter Association. Also elected were **Richard M. Voils, Jr.,** General Petroleum Corp., vice president, and **George H. Forster, Jr.,** The Texas Co., secretary-treasurer.

R. B. Gaines has joined the gas reserves and availability section of the gas supply department of Northern Natural Gas Co., Omaha, as geological engineer. Gaines has served in geological and geophysical capacities with Stanolind Oil & Gas Co. in Houston, and Ohio Oil Co. in Midland, and was with Southern California Petroleum Corp. immediately prior to joining Northern.

Robert J. McGalliard, Jr., has been named regional geologist in charge of Gulf Coast operations for Leche Oil Co., Inc., Fort Worth.

Everett C. Parker, district geologist for Continental Oil Co. at Ardmore, Okla., has left the company after 38 years and is opening offices at Ardmore.

Thomas S. Yancey, district exploration superintendent for Stanolind Oil & Gas Co. at Casper, Wyo., has been promoted to division landman. **C. L. Walker,** formerly district geologist at Casper, has become district exploration superintendent, and **Ian Macartney,** division geophysical coordinator, has become district geologist.

Benjamin G. Jones, Concord, Calif., and **James McDonald,** Westfield, N. J., have been named assistant managers of

B. G. JONES

J. McDONALD

Tidewater Oil Co.'s new Delaware Flying A refinery near Wilmington. Jones was formerly superintendent of cracking at the Avon Flying A refinery in California. McDonald, formerly assistant process engineer at the Bayonne plant, has recently been engaged in engineering phases of the new refinery. **John T. McCoy,** divisional research and development supervisor, has been appointed manufacturing department coordinator, representing the Delaware plant in the New York office.

L. W. (Bill) Goudy, formerly with Stanolind Oil & Gas Co., has been appointed chief geologist for Vickers Petroleum Co., Inc., Wichita. Goudy had been with Stanolind since 1940 and was most recently district geologist at Wichita.

Barney Pate has been appointed geologist and **Arthur H. Smith** manager of the land department at Monroe, La., for Southwest Gas Producing Co., Inc. At the Lafayette district office, **A. E. Beasley** has been named manager and **Joseph F. Moss,** formerly with Sun Oil Co., district geologist.

M. E. (Bones) Foster is opening offices in Bartlesville, Okla., as a consultant in the general field of oil-industry supply, distribution, and transportation. Foster retired June 30 as president of Phillips Pipe Line Co. after more than 32 years with the Phillips organization.

M. Dale McBride, vice president and comptroller of Arrow Drilling Co., Tulsa, has resigned after 20 years with the company.

William J. Sparks, Westfield, N. J., director of the chemicals research division of Esso Research & Engineering Co., has received the distinguished alumni service award from Indiana University.

R. D. Turner, special assistant to the president for natural gas of Skelly Oil Co., resigned July 1 to engage in private gas engineering and consulting work. Turner has been connected with the natural gas and natural gasoline departments of Skelly since joining the firm in 1921.

J. W. Sharman is president of the recently formed pipeline contracting firm of Sharman, Allen, Gay & Taylor, Inc., Houston. Other officers are **John Gay** and **S. A. Taylor.** All were formerly with Associated Pipe Line Contractors, Inc., and several other firms in the field.

R. C. Frederick has rejoined Gulf Oil Corp. in the planning and economics department after an absence of 8 months. He becomes planning coordinator for natural-gas liquids, gasolines, and L.P.G. Frederick has recently been vice president in charge of gas purchases and gas sales for Pacific Northwest Pipe Line Corp. in Houston. Prior to leaving Gulf, he was coordinator for gas and gas liquids in the production department.

Earl C. Overbeck, chairman of the board of Ohio Fuel Gas Co., has retired after a 43-year career with the company. The position of board chairman will not be filled immediately. **Allan W. Lundstrum,** president, becomes chief executive officer. Overbeck joined the old Ohio Fuel Supply Co. at Ashland, Ohio, in 1913. After moving to Columbus, he became vice president of production, transmission and engineering in 1947, president in 1950, and board chairman a year later.

Personals

J. W. Kirstein, field superintendent of pipelines for Natural Gas Pipeline Co. of America, has been transferred from Fritch, Tex., to Beatrice, Neb.

J. W. MORTON

John W. Morton has been named assistant chief engineer for Cities Service Gas Co. in Oklahoma City. Morton joined Cities Service in 1943. In 1950, he was placed in charge of the company's large compressor plant, pipeline division and shop at Caney, Kans. Since then, he has worked on pipeline and compressor station operation problems in Oklahoma City.

Paul W. Rogers, chief engineer of Ohio Fuel Co., Columbus, Ohio, has been elected a vice president. Rogers became assistant chief engineer in 1952 and chief engineer a year later. He was made an assistant vice president in 1954. Rogers joined Ohio Fuel 22 years ago. He has served as superintendent of motor transportation and head of Mount Vernon shops and warehouses, and supervisor of welding instructions.

Max A. Mosesman has been promoted to research specialist in the research and development division of Humble Oil & Refining Co.'s Baytown, Tex., refinery. **Tom F. Stephens** and **Irving Leibson** have been named senior chemical engineers in the technical service division of the Baytown plant.

H. S. Sparrow, British American Oil Co., Ltd., has been appointed to the newly created position of general manager of the crude and products supply department. Sparrow joined B-A in 1943 as a chemist at the Calgary refinery. He was made assistant manager at the Edmonton refinery in 1953, and has most recently been assistant manager at B-A's Montreal East plant.

Robert P. Mangold has been appointed manager of field operations at Bakersfield, Calif., for Reserve Oil & Gas Co., replacing **Max C. Eastman,** who was recently promoted to executive vice president. For the past 4 years Mangold has been operations manager for D. K. Partnerships in various joint ventures with Reserve in the Tejon Ranch area.

Norman E. Thompson, formerly district geologist for Lion Oil Co., a division of Monsanto Chemical Co., in Corpus Christi, Tex., has joined Nortex Oil & Gas Corp. in Corpus Christi as district geologist.

L. A. Curran, formerly general manager of refining operations for Aurora Gasoline Co., Detroit, has been appointed assistant vice president in charge of manufacturing. **P. A. Blasco,** formerly assistant general manager of refining operations, has succeeded Curran as general manager.

Assistant Defense Secretary **Thomas P. Pike,** former West Coast drilling contractor, has been appointed by President Eisenhower as special assistant in charge of liaison between government departments and agencies.

W. T. ASKEW

Wilburn T. Askew has been elected president of Sun Oil Co., Ltd., effective September 1. Askew, until recently manager of the parent Sun Oil Co.'s Marcus Hook refinery, succeeds **Joseph N. Pew, Jr.,** as president of the Canadian subsidiary. Askew joined Sun Oil in 1931 as a chemical engineer at Marcus Hook. After serving as assistant superintendent, superintendent, and assistant manager of the plant, he became manager in 1954.

Adolph F. Spiehler has been appointed manager of the technical department in Pure Oil Co.'s refining division. **William S. McConnor** has succeeded him as operations manager of the division's operating department.

A. R. (Al) West, formerly division manager of Carter Oil Co.'s southern division in Shreveport, has joined Tennessee Gas Transmission Co. as production manager. West began with Carter in 1930, joined Tropical Oil Co. at El Centro, Colombia, in 1931, and returned to Carter in Oklahoma City 6 years later. He had been southern division manager since 1953.

Noah Roads has been promoted to engineer with Tennessee Gas Transmission Co. in Houston. He formerly was field party chief in the northeast area of the U. S.

Robert S. Jefferies, Gibsonia, Pa., formerly chief engineer for New York State Natural Gas Corp., has been promoted to the newly created position of manager of gas storage. Jefferies will continue as supervisor of compressor station operations.

Lester B. Swan, general manager of the Brazos Oil & Gas division of Dow Chemical Co., Houston, has been elected a director of Dowell Incorporated. Swan joined Dowell in 1940. After several posts in the Mid-Continent area, he became vice president and general manager of Dowell's Latin American affiliate, United Oilwell Service, S. A., in Caracas. In 1953, he joined another Dow Chemical subsidiary, Brazos Oil & Gas Co., in Houston. Brazos became a division of the parent firm in 1955.

DEATHS

Charles F. Felton, Sr., 58, sales manager of Franklin Creek Refining Co., subsidiary of L. Sonneborn Sons, Inc., died recently in Titusville, Pa. Felton had been associated with Franklin Creek for 20 years. Prior to that, he was with Continental Refining Co., Oil City, Pa., for 15 years.

G. K. Eysaman, 32, area manager of Mobiloil Nigeria, Ltd., at Ibadan, Nigeria, was killed June 24 in the crash of a British airliner in northern Nigeria.

W. C. (Bing) Meeks, 75, district representative of S. M. Jones Co. in Wichita, died there recently.

Charles Bruce Wilson, 67, manager of the production department of United Carbon Co.'s oil and gas division, died recently at Welch, W. Va. Wilson had been associated with United Carbon and its subsidiary, United Producing Co., for more than 26 years.

Fleming Warren Abshire, 68, prominent Tulsa oil operator, died there June 26. Abshire had been associated with Glenn J. Smith and Wood Oil Co. in Tulsa since 1925.

Travis Dickey, 65, retired field superintendent for Jack W. Frazier, independent Houston operator, died recently in Richmond, Tex.

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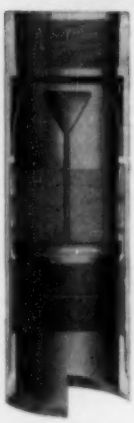

Packer Type Bowen Releasing Casing Bowls are used with great effectiveness in wells with casing difficulties. The standard procedure is to make a cut with an Internal Cutter in the casing immediately below the damaged area and to pull the casing from the hole. The damaged portion of the casing string is then replaced with good casing. A Packer Type Bowen Releasing Casing Bowl is then installed on the bottom end and lowered over the casing in the hole. When upward pull is exerted, the tapers on the Cone contract the Slips into secure engagements with the casing and the Cone bears against and compresses the lead Packing into a leak-proof seal around the casing.

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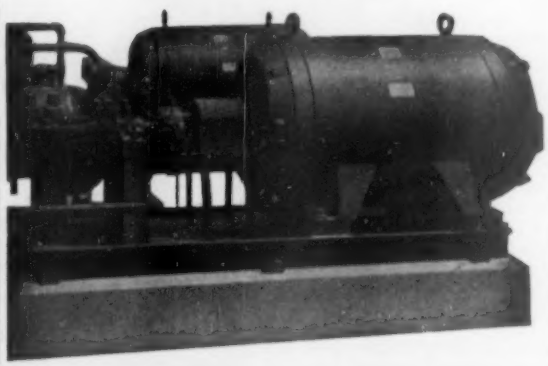

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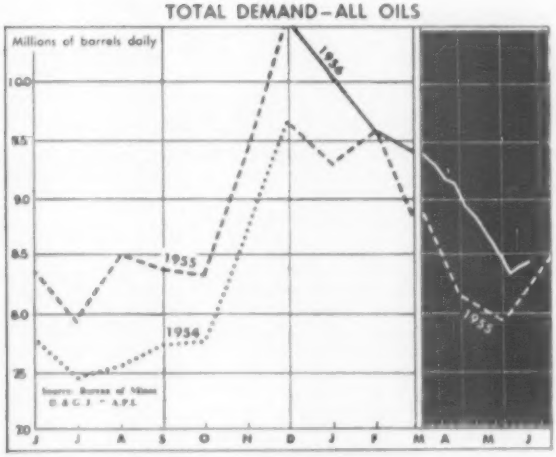
Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,063,200	UP	5,850	UP	439,228
Crude stocks	274,075,000	DOWN	1,072,000	DOWN	1,693,000
Completions	1,223	UP	157	DOWN	3
Refinery runs	8,087,000	UP	134,000	UP	623,000
Gasoline stocks	180,725,000	DOWN	762,000	UP	16,254,000
Kerosine stocks	24,583,000	UP	790,000	DOWN	4,549,000
Distillate stocks	87,793,000	UP	2,797,000	DOWN	8,545,000
Residual stocks	38,050,000	UP	731,000	DOWN	7,534,000
Four-product stocks	331,151,000	UP	3,556,000	DOWN	4,374,000
Total imports	1,651,200	UP	453,000	UP	610,600

TOTAL DEMAND—ALL OILS



Increased Crude Supply Boosts Crude Demand, But Only for a Short Time

INCREASES in crude supply will tend to boost demand for crude but only for short periods. The abnormal periods must be followed by weeks or even months of disagreeable adjustments.

Market demand for domestic crude in a given month means the amount of domestic crude that disappeared during the month. There are only four classifications used to account for this demand for crude. The first is crude input at refineries. The second is crude exports. The third covers transfers to fuel, and the remainder is carried as a loss.

Refinery runs accounted for 98.7 per cent of the demand for domestic crude in the first quarter of this year and 98.8 per cent of demand for all crudes. Anything that influences refinery runs will tend to change demand for crude.

Excessive crude supplies tend to boost refinery runs. When increases in state allowables are stacked on top of excessive imports of foreign crude, refiners or crude-purchasing department for refiners are under pressure to find storage for the surplus. In some cases, the refiner will decide that the only way to handle the surplus is to store part of it in the form of products. This may produce abnormal seasonal changes in refinery runs and can create marketing problems.

Conditions in 1953 present an example of the influence of excessive crude supplies on refinery operations. Crude imports for the year gained 13 per cent, with highest averages in the second and third quarters when demand for finished products is down. Domestic production of crude averaged more for the June-September period than for either January or February. The result was increased refinery operations that added 46,600,000 bbl. to refined product inventories during the year.

Texas allowables averaged more than 3,000,000 bbl. daily for each month of the June-September period in 1953 but had to be cut during the winter months when demand normally is at a peak.

Operators may want to review the supply-and-demand picture for 1953 before deciding what to do with surplus crude during July.

Residual markets vary by areas . . . Esso Standard Oil Co. raised prices on heavy fuels in its territory, effective June 22. The new barge price for Bunker C in New York Harbor is $2.80 a barrel.

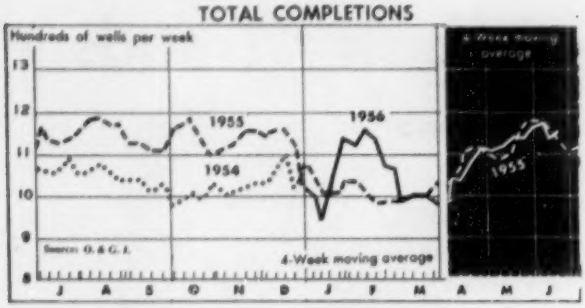
Residual markets in the Mid-Continent and North Central areas have been under the influence of reduced purchases by steel mills for the past few weeks. More low-sulfur material has been available for spot sales, but there has been no evidence of dumping. A prolonged steel strike would produce lower prices on the Group 3 market.

Service-station price wars at Oklahoma City and Tulsa are clearing up, but latest reports still show subnormal markets in the Kansas City area.

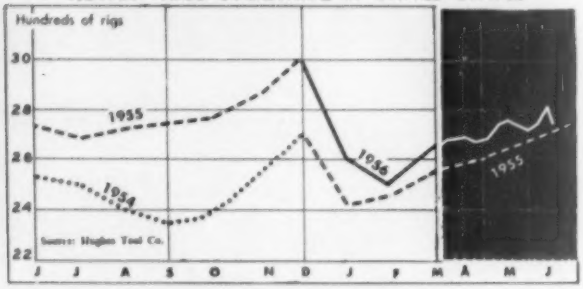
Atlantic Refining Co. announced a plan to "fair trade" service-station gasoline in Pennsylvania. Prices to dealers will be 23 per cent off the company's fair-trade retail price, exclusive of taxes.

Total product demand for the 4-week period ended June 22 was 5.1 per cent above demand for the same period last year. Middle-distillate demand was up. Despite the lack of reports of market activity in distillates, demand for this group was up 10.5 per cent from last year. Residual was up only 0.6 per cent.

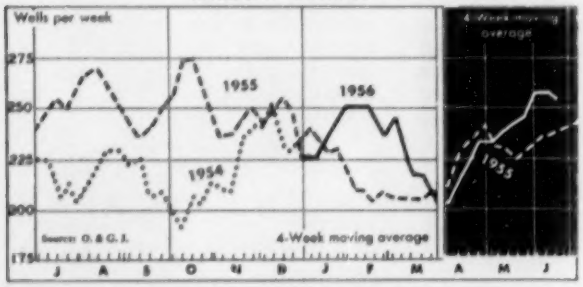
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	6-25-56	6-18-56	6-27-55
North Central and East	130	151	158
Southeast	30	35	36
Okla., Kans., Ark., Mo.	506	501	512
Louisiana	448	471	424
North and East Texas-Panhandle	426	432	389
Gulf and South Texas	272	251	242
West Texas-New Mexico	545	574	519
Rocky Mountain	262	276	280
Pacific Coast	123	128	153
Total United States	2,742	2,819	2,713
Western Canada	252	243	195

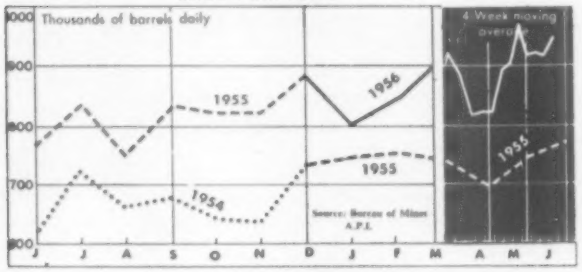
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JUNE 23, 1956

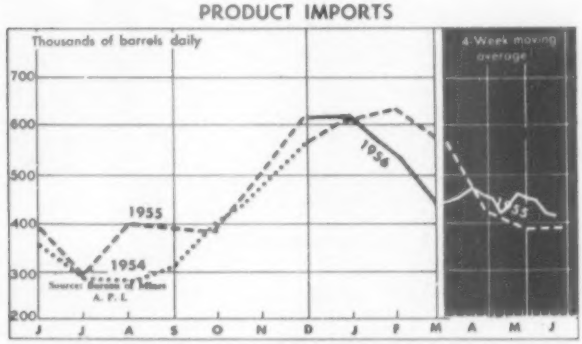
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1956				
	Comp.	Oil	Gas	Dry	Footage	1956	1955	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	4	3	0	1	35,333	49	41	0	0	0	1	1	0	0	1	23	24
Arkansas	19	13	0	6	47,515	375	346	2	0	0	4	6	19	0	3	62	84
California	59	43	2	14	278,958	1,066	1,252	1	0	0	8	9	21	0	3	197	221
Colorado	26	12	3	11	126,434	560	669	2	0	0	7	9	16	0	6	244	266
Illinois	67	26	0	41	157,942	1,698	1,761	0	0	0	11	11	27	0	0	291	318
Indiana	12	4	0	8	21,201	293	368	0	0	0	3	3	9	0	1	56	66
Kansas	96	41	3	*52	331,701	2,438	2,453	3	0	1	24	28	61	2	13	436	512
Kentucky	54	22	7	25	65,527	789	610	2	0	0	8	10	23	0	1	169	193
Louisiana	117	73	9	35	785,789	1,880	1,925	3	2	0	8	13	55	31	29	245	360
North	63	44	4	15	196,784	762	1,036	2	0	0	5	7	15	1	1	94	111
South	44	23	4	17	483,269	894	889	1	2	0	3	6	32	27	19	135	213
Offshore	10	6	1	3	105,736	224		0	0	0	0	0	8	3	9	16	36
Michigan	14	6	0	8	41,146	218	249	0	0	0	3	3	5	0	0	71	76
Mississippi	13	3	1	9	107,172	211	234	1	0	0	6	7	8	1	1	81	91
Montana	8	5	0	3	28,877	167	151	0	0	0	1	1	7	0	0	42	49
Nebraska	34	16	0	18	200,436	499	341	1	0	0	12	13	20	0	0	225	245
New Mexico	34	23	4	7	181,405	881	732	1	0	0	5	6	25	0	5	80	110
Northwest	5	2	3	0	24,323	333	212	0	0	0	0	0	2	0	5	22	29
Southeast	29	21	1	7	157,082	548	520	1	0	0	5	6	23	0	0	58	81
North Dakota	9	6	0	3	70,473	116	108	0	0	0	1	1	7	0	0	22	29
Ohio	22	12	2	*8	54,266	493	531	0	0	0	0	0	0	0	1	4	5
Oklahoma	172	106	10	†56	576,973	4,197	4,120	0	1	2	18	21	64	15	23	353	455
Pennsylvania-New York	7	0	6	1	17,310	434	805	0	0	0	0	0	0	0	4	3	7
Texas	430	291	16	123	1,683,394	10,524	9,557	8	0	4	82	94	359	20	90	2,265	2,734
Southwest (1 & 4)	83	51	6	26	283,264	1,550	1,483	1	0	1	18	20	69	5	31	422	527
Gulf Coast (2 & 3)	42	24	2	16	219,555	1,292	1,232	1	0	1	10	12	34	8	34	337	413
East (5 & 6)	15	4	2	9	72,670	536	466	0	0	0	6	6	7	1	5	196	209
North Central (7-B & 9)	150	96	1	53	481,933	3,796	3,497	2	0	0	31	33	155	0	3	903	1,061
West (7-C & 8)	108	91	1	16	496,712	2,737	2,407	3	0	1	16	20	89	0	8	378	475
Panhandle (10)	32	25	4	3	129,260	613	472	1	0	1	1	3	5	6	9	29	49
Utah	3	0	3	0	14,960	41	37	0	0	0	0	0	1	0	2	21	24
West Virginia	11	2	6	3	32,228	318	290	0	0	0	2	2	0	0	3	8	11
Wyoming	12	7	2	3	56,370	363	368	0	0	0	3	3	8	0	5	91	104
Miscellaneous	0	0	0	0	0	58	17	0	0	0	0	0	4	0	0	46	50
Total United States	**1,223**	714	74	435	4,915,410	27,668	26,965	24	3	7	207	**241**	739	69	191	5,035	6,034
Total previous week	1,066	553	68	445	4,437,627			30	0	9	217	256	715	66	184	4,828	5,793
Total June 25,1955	1,226	682	71	473	4,749,204			38	3	8	219	268	744	103	177	4,600	5,624
Cumulative 1956	27,668	15,252	1,812	10,604	112,799,731												
Western Canada	62	48	6	8	350,661	1,154											

Service wells included: *2, †11.

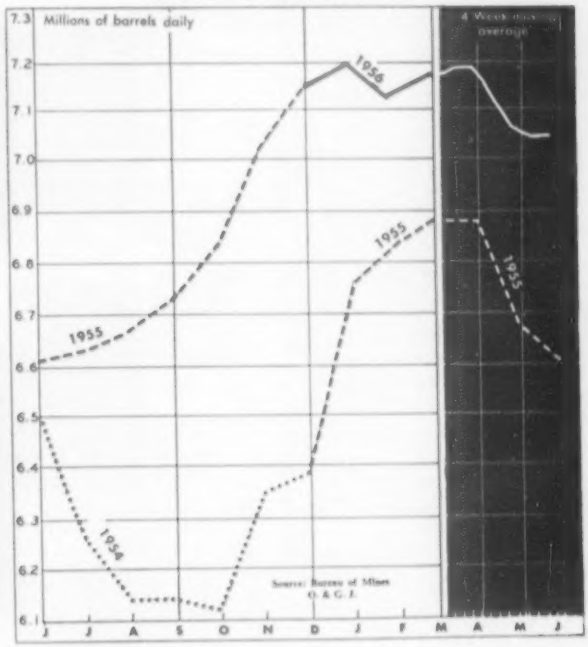
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

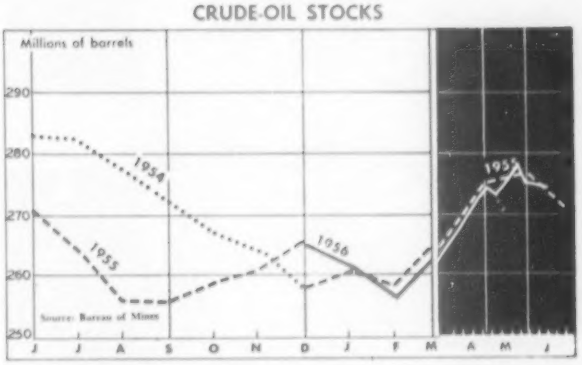


DAILY AVERAGE PRODUCTION FOR WEEK

	June 23, 1956			June 16
	Crude oil	Lease condensate	Total	total
Alabama	5,200		5,200	5,100
Arkansas	74,700	450	75,150	75,600
California	965,600		965,600	966,500
Colorado	168,000		168,000	167,000
Eastern	50,100		50,100	49,200
Florida	1,350		1,350	1,350
Illinois	226,800		226,800	226,700
Indiana	31,300		31,300	31,700
Kansas	343,800		343,800	338,500
Kentucky	47,700		47,700	48,300
Louisiana	724,700	60,400	785,100	785,900
North	120,700	2,400	123,100	123,900
South	604,000	58,000	662,000	662,000
Michigan	29,600		29,600	29,900
Mississippi	106,800	4,250	111,050	111,050
Montana	59,200		59,200	60,100
Nebraska	40,700		40,700	38,600
New Mexico	235,600	4,600	240,200	240,300
North Dakota	32,900		32,900	30,100
Oklahoma	599,800		599,800	604,000
Texas	2,908,000	48,450	2,956,450	2,956,450
Dist. 1	54,000	425	54,425	54,425
Dist. 2	145,000	8,025	153,025	153,025
Dist. 3	428,000	22,625	450,625	450,625
Dist. 4	231,000	5,350	236,350	236,350
Dist. 5	44,000	425	44,425	44,425
Dist. 6	120,000	5,500	125,500	125,500
East Texas field	204,000		204,000	204,000
Dist. 7-B	153,000	50	153,050	153,050
Dist. 7-C	184,000	3,800	187,800	187,800
Dist. 8	1,034,000	1,700	1,035,700	1,035,700
Dist. 9	216,000	400	216,400	216,400
Dist. 10	95,000	150	95,150	95,150
Utah	5,200		5,200	5,100
Wyoming	287,800		287,800	285,600
Others	‡200		‡200	300
Total U. S.	6,945,050	118,150	**7,063,200**	7,057,350
Change from previous, up			**5,850**	
Canada	†427,100		†427,100	†421,400
Total U. S. production January 1-June 23			1,253,682,480 bbl.	
Same period last year (crude plus cond.)			*1,179,938,550 bbl.	

*Includes 19,658,650 bbl. condensate. †Week ended previous Monday. ‡Nev. 200.

CRUDE-OIL STOCKS



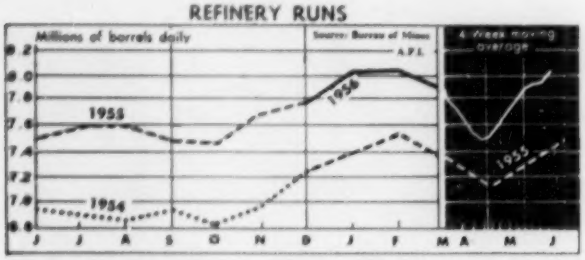
CRUDE-OIL STOCKS BY STATES OR ORIGIN*

(Thousands of barrels)

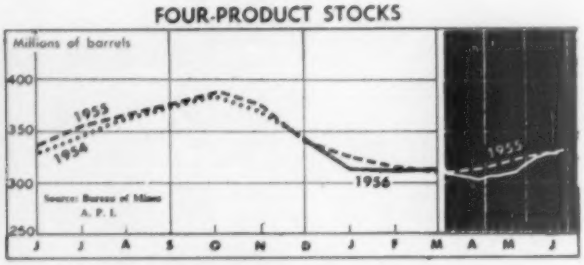
	6-16-56	6-9-56	6-18-55
Pennsylvania Grade	2,606	2,728	2,809
Other Appalachian	2,255	2,397	1,937
Illinois, Indiana, Michigan	10,760	10,728	11,939
Nebraska, North Dakota	2,634	2,535	2,025
Kansas	9,193	8,919	8,547
Oklahoma	27,294	27,571	24,035
Arkansas	3,098	3,040	2,913
Louisiana	15,570	16,115	15,458
North	2,558	2,572	2,650
South	13,012	13,543	12,808
Mississippi	3,054	3,149	3,010
New Mexico	7,349	7,612	8,464
Texas	124,042	124,658	129,504
East Texas proper	9,172	9,368	10,284
West Texas	60,362	60,544	57,313
Texas Gulf	21,859	22,403	26,477
Other Texas	32,649	32,343	35,430
Wyoming	18,216	18,072	16,042
Other Rocky Mountain	6,169	5,885	5,142
California	27,511	28,115	31,571
Foreign	†14,324	13,623	12,372
Total	274,075	275,147	275,768

*Bureau of Mines. †Includes 4,112,000 bbl. in California.

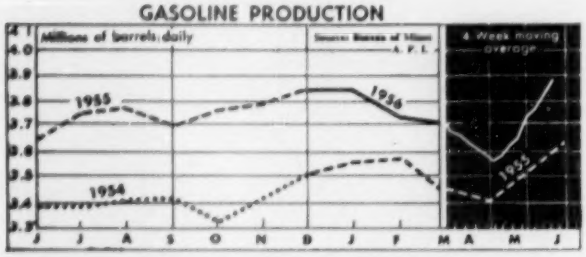
REFINERY RUNS



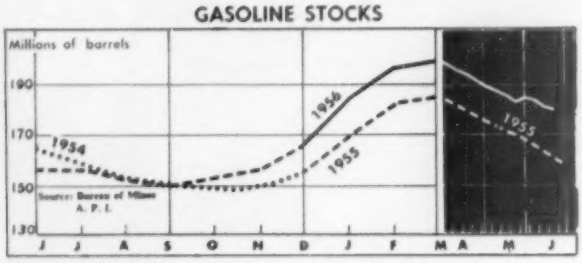
FOUR-PRODUCT STOCKS



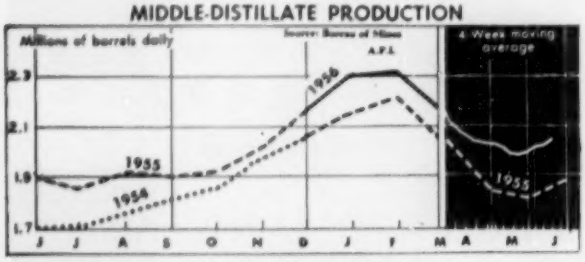
GASOLINE PRODUCTION



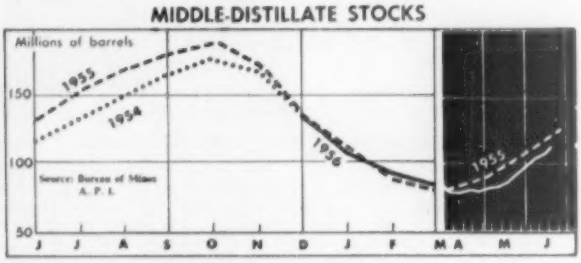
GASOLINE STOCKS



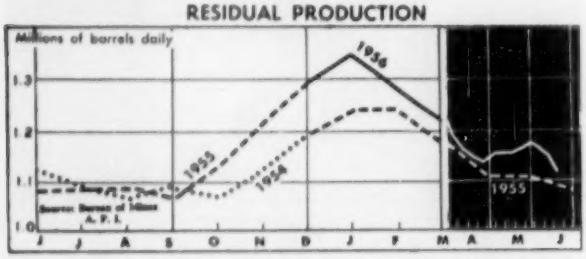
MIDDLE-DISTILLATE PRODUCTION



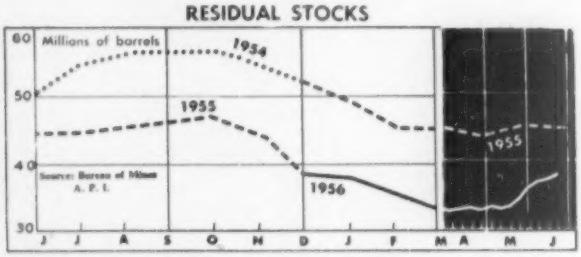
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, JUNE 22

(Thousands of barrels)

District—	Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.	Stocks‡: Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, June 1955: Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.
East Coast	1,149	465.4	41.9	274.9	201.0	40,002	9,610	25,280	9,463	1,026	421.9	27.4	253.9	176.7
Appalachian:														
District 1	107	41.9	2.4	28.0	5.1	4,453	453	1,592	342	91	34.3	2.9	20.9	4.6
District 2	98	52.9	3.7	14.4	14.4	2,869	554	682	242	100	50.3	4.0	13.2	10.7
Ind., Ill., Ky.	1,346	677.7	60.0	258.4	142.8	33,480	4,394	12,527	4,204	1,404	748.5	63.0	259.3	165.0
Minn., Wis., Dak.	93	44.6	5.4	26.0	8.3	6,933	709	4,193	274	($)	($)	($)	($)	($)
Okla., Kans., Mo.	702	394.7	12.3	183.4	25.3	16,024	1,279	8,902	1,217	704	414.4	19.9	153.5	30.3
Inland Texas	285	202.7	6.0	57.9	24.4	6,604	426	1,809	1,402	247	176.4	8.1	47.5	20.4
Texas Gulf Coast	2,076	939.7	102.0	539.1	264.3	24,818	3,538	12,514	5,267	1,811	845.7	91.8	435.1	241.2
La. Gulf Coast	755	379.1	30.0	190.4	51.3	9,785	2,379	5,919	1,681	675	338.6	36.6	188.1	51.4
N. La. and Ark.	97	34.7	7.0	25.0	6.6	4,110	515	1,545	160	95	35.3	6.1	24.2	6.1
Rocky Mountain:														
New Mexico	23	11.7		3.9	2.9	426	7	88	11	23	10.6	0.5	3.7	3.2
Other Rocky Mtn.	284	128.9	4.4	59.9	34.3	7,207	332	2,558	856	268	119.3	3.9	61.4	33.1
California	1,072	520.7	4.0	122.6	318.7	24,014	387	10,184	12,931	1,040	447.8	5.3	167.2	337.0
June 22, 1956	8,087	3,894.7	279.1	1,783.9	1,099.4	180,725	24,583	87,793	38,050	7,484	3,643.1	269.5	1,628.0	1,079.7
June 15, 1956	7,953	3,909.0	290.6	1,720.6	1,080.4	181,487	23,793	84,996	37,319	.....	.....	.....	.....	.....
June 24, 1955	7,464	3,692.9	278.0	1,646.0	1,087.9	164,471	29,132	96,338	45,584	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Included in Indiana, Illinois, and Kentucky.

Crude-oil and refinery prices at representative U. S. and foreign points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):

Regular (88 octane)	11.50-12.00
Premium (96 octane)	13.25-13.75

Gulf Coast (cargoes for coastwise or export movement):

Regular (90 octane)	11.25-11.50
Regular (92 octane)	11.50-12.00
Premium (97 octane)	13.00-13.25
Premium (98 octane)	13.25-13.75

California—Los Angeles (rack):

★ Regular (84 octane)	12.9-13.3
★ Premium (93 octane)	14.9-15.3

Caribbean area (cargoes):

Regular (87 octane)	10.50
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):

Kerosine 42-44	10.00-10.25
Diesel oil (58 d.i. and above)	9.625-9.875
Distillate No. 1	9.625-9.875
Distillate No. 2	8.75-9.00

Gulf Coast (cargoes):

Kerosine 41-43	9.5
Distillate No. 2	8.75-9.25

New York Harbor (barges):

Kerosine 41-43	10.85
Distillate No. 2	10.35
Diesel fuel, 48-52 d.i.	10.65

Caribbean area (cargoes):

Distillate No. 2	8.75

WAX (LB.)

Oklahoma (Group 3):

132-135 A.m.p. (semi-refined) in tank cars	6.50

New York (export):

126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.00-2.10
Gulf Coast (cargoes):	
Bunker C fuel	$2.10
New York Harbor (barges):	
★ Bunker C fuel	$2.80
Caribbean (cargoes):	
Bunker C at Aruba, N.W.I.	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.15-2.25

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	26
200 vis. neutral (180 at 100°), 25 p.t.	23

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.02	....	....	....	....
15-15.9	2.08	....	....	....	....
16-16.9	2.13	....	....	....	....
17-17.9	2.19	....	....	....	....
18-18.9	2.24	....	....	....	....
19-19.9	2.30	....	....	....	....
20-20.9	2.35	$2.50	....	$2.37	....
21-21.9	2.41	2.52	....	2.39	....
22-22.9	2.47	2.54	....	2.41	....
23-23.9	2.52	2.56	....	2.43	....
24-24.9	2.58	2.58	$2.91	2.45	....
25-25.9	2.64	2.60	2.93	2.47	$2.13
26-26.9	2.69	2.62	2.95	2.49	2.19
27-27.9	2.76	2.64	2.97	2.51	2.24
28-28.9	2.83	2.66	2.99	2.53	2.29
29-29.9	2.91	2.68	3.01	2.55	2.34
30-30.9	2.97	2.70	3.03	2.57	2.39
31-31.9	3.04	2.72	3.05	2.59	2.44
32-32.9	3.12	2.74	3.07	2.61	2.48
33-33.9	3.20	2.76	3.09	2.63	2.52
34-34.9	3.27	2.78	3.11	2.65	2.56
35-35.9	3.34	2.80	3.13	2.67	2.60
36-36.9	3.39	2.82	3.15	2.69	2.64
37-37.9	....	2.84	3.17	2.71	2.66
38-38.9	....	2.86	3.19	2.73	2.68
39-39.9	....	2.88	3.21	2.75	2.70
40 and up	....	2.90	3.23	2.77	2.72

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas. †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, February 7, 1956; east of California, June 15, 1953; Pennsylvania Grade, May 16, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.45
Middle District	4.32
Southwest Pennsylvania	4.03
West Virginia	3.91
Buckeye Grade	3.85
Zanesville Grade	3.10
Illinois Basin	**2.90**
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.8°, Tucupido	*3.40
San Joaquín, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	*2.80
Tia Juana medium, 26.5°-26.9°, Amuay	‡2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.46
Iraq, 36.0°-36.9°, Tripoli, Banias	2.46
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

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(Latest reported spot fixtures)

★ Gulf-U.S.N.H., dirty (USMC+57.5%)	$4.49
★ N.W.I.-U.K., dirty (Scale+90%) (61s. 9d.)	8.64
★ N.W.I.-U.S.N.H., dirty (USMC+50%)	4.05
★ P.G.-U.S.N.H., dirty (USMC+45%)	18.42
★ P.G.-France, dirty (USMC+35%)	14.72
★ P.G.-U.K., dirty (Scale+112.5%) (114s. 11d.)	16.08

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U-15 DRILLING RIG located 5 miles North of Laverne, Oklahoma, now operating. 3 NKU Waukesha Motors. Hydraulic Floor Operated Blowout Preventor, 131' Lee C. Moore Mast, steel mud pits, 7¾ x 16 Gardner-Denver Pump, 8000' 4½" Drill Pipe, recomplete. Call CE 2-6318, Oklahoma City, Oklahoma.

NATIONAL 50—Compounded Rig—C-250 Pump—3100 ft. 4½" Drill Pipe—Extra EK Waukesha Motor—87' Lee C. Moore, Jack Knife Derrick and all other tools and equipment ready to drill. BARGAIN. G. W. Miller Drilling Company, P. O. Box 208, Mt. Carmel, Illinois. Phones 904 and 1154.

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Offers entertained for purchase of four 150,000 barrel welded, cone-roof, oil-storage tanks; 150 x 48 feet. Constructed to A.P.I. standard 12-C less than 7 years ago. Available July 1st, 1956.

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FOR SALE—Joy 350 Drilling Rig Complete. Trailer mounted. For information call POrter 3-4687, Lubbock, Texas.

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3000, 12⅜" —8 thread collars with Dutchman. 5000 —8" —8 thread collars with Dutchman.

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P. O. BOX 1798

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BOX J-592
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

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RECORDING INSTRUMENTS, fair condition, mounted on good truck. Dual power reels and cables. Bargain. Box J-460, The Oil and Gas Journal, Tulsa, Oklahoma.

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Choice of plain end or T&C. Ideal for oil, water and gas systems, 850 to 900 psi. Pipe located in Illinois, with low barge, rail and water rates to any part of the world. Priced below market, selling at almost ½ cost of equivalent new pipe. Will sell for cash or will finance meritorious propositions.

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COMPLETE POLY UNIT, BUILT 1950
UOP RATED 144 BBL./DAY

1—Wyatt 30" x 70' Stabilizer 160# 30 tray
20—Brown fintube exchangers, 600# 140 sq. ft. 4-6 chrome.
20—Brown fintube exchangers, 600# 11, 21, 77, 101, 140 sq. ft.
5—Adm. Heat Exchangers, 644, 424, 346, 176 sq. ft.
1—5' x 98' tower, 40 tray, 135# WP.
1—7' x 30' Propane tank, 250# WP.
1—6' x 34' Vacuum tower, 150#.
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7—Oilfield boilers, 100 hp., 275#
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8—Hi-vol pumps, 10 x 7 x 18, 10 x 6 x 12, 6 x 4 x 12, 6 x 3 x 8.
30—Duplex piston pumps, all sizes.
1—10' x 30' asphalt still.
6—Steel Bldgs., 20 x 150, 20 x 20, 20 x 40,
1—BS&B Oil and gas separator, 10.7 mcf, 3500 BBL./day.
Large Selection of Series 15, 30 Steel Valves, 1" to 8".
Approximately 15,000 ft. Schedule 40, 80 pipe, 2" to 8".

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8' x 75' 25 tray 40#
2' x 60' 35 tray 560#
5'6" x 59' 30 tray 200#
2' x 42' 30 tray 250#
13" x 35' 30 tray 500#
2—8½' x 25' hor tanks 50# WP.

COMPRESSORS

2 Worth LTC-6 800 hp.
1 Worth LTC-3 400 hp.
1 IR XVG-8 300 hp.
3 Penn Comps 43 CFM 500 lbs. 276 CFM 160 lbs., 230 CFM 150 lbs.

MISCELLANEOUS

6—Adm. 785, 742, 425 sq. ft. ht. exch.
30—304 SS shell & tube condensers 100-1000 sq. ft.
Lab Petro-Chem furnace 50,000 BTU/hr.
800 ft. of 2" 4-6 ch pipe
Large quantity of 410 SS chrome strips and sheets.
Tremendous selection stainless steel and steel valves ½"-6".
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CLARK GAS COMPRESSORS: Two used 1949, Model RA-4, Type VIH 400 Horse Power, 87,000 cubic feet per hour, 159.7 P.S.I. Maximum discharge pressure, very good condition. Contact The Standard Oil Co. (Ohio) 1646 Midland Bldg., Cleveland, Ohio, Attn.: Mr. W. R. Fisher.

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5,000' rig, Wilson Giant drawworks with 6NK-18A Waukesha; 212 P Oilwell mud pump, with NKU Waukesha; 5,000' of 4½" Natl Smls Internal upset 16.6# drill pipe, with Hughes API full hole seal grip tool joints, 122' standard derrick, rig complete.

2,000' truck mounted rig. Wilson super winch with 6MZ Waukesha; 5 x 10 Oilwell mud pump with 145 h.p. Climax engine; 3,000' of 3½" 13.30# drill pipe; 50' telescoping mast, rig complete.

Phone 4-5942 or Write
P. O. Box 89
Tyler, Texas

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"As is, where is" basis, one used Derrick and Hoist Corporation shipbuilding type revolving Gantry Crane, load rate 80,000# at radius of 30' utilizes 440 volt current—Part of travel and hoisting equipment has been removed—May be inspected by contacting R. G. Rhodes, Phillips Chemical Company's Adams Terminal Plant, Pasadena, Texas. After inspection, all inquiries should be directed to

L. F. Mayfield
Phillips Petroleum Company
Adams Building
Bartlesville, Oklahoma

FOR SALE EQUIPMENT

FOR SALE—Approximately 44,000 feet good used 6⅝ inch lap weld line pipe, Double Random, beveled, racked at Neal, Kansas. Kenland Oil Company, 823 South Detroit Tulsa. Telephone DIamond 3-4933.

CORE DRILLS, SPUDDERS, ROTARIES. New and used equipment. Everything in supplies. Fishing tools rented. Pressey & Son, Pueblo, Colo.

FOR SALE—Near Eureka, Kansas, 4 miles 2" No. 1 single length line pipe, beveled for welding, 25 cents per foot. Contact C. W. Schwenker phone 644, El Dorado, Kansas, or write Cities Service Oil, Patridge, Bartlesville, Oklahoma.

FOR SALE—At our Tallant chemical plant which we are dismantling 20—10' x 18' vertical steel tanks, $500.00 each suitable for salt water, oil, and other liquids; also a quantity of various sizes vertical and horizontal tanks. See T. P. Mace at the plant, or write H. D. Patridge, Cities Service Oil, Bartlesville, Oklahoma.

FOR SALE: National 50 Drilling Rig Complete, for details, call or write Ralph W. Shebester, Box 337 Pauls Valley, Oklahoma. Telephone 570.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units, Westinghouse 20-25-50 KW Generating Units.

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1—800# 20 MMCF Absorber with Scrubber, etc.

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6000 FT. CAPACITY WELL SERVICING UNIT

Located at Odessa, Texas

Model E-563-42 Fred E. Cooper - Allis-Chalmers Single Drum Servicing Unit with Two-Pole, 65 Ft. High Telescoping Mast powered by Model AM-1153-54 Allis-Chalmers Engine; Mounted on L-192 International Truck, 1953 Model.

Excellent condition. Unit new 1950. Truck new 1953, only 3000 road miles. Rig includes blocks, rod and tubing equipment and hand tools.

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FOR SALE EQUIPMENT

FOR SALE—2 truck mounted Bettis steam units. Good condition, equipped for oil field work. Box J-332, The Oil and Gas Journal, Tulsa, Oklahoma.

2 GMC MODEL #12103 Twin Six Diesel Engines, excellent condition—one with 11,000 series torque converter, $4600; other without torque, $4000. See at Carter Engine Works or call Dixon Drilling Company, 4-8503, Abilene, Texas.

FOR SALE: Two new 32" Parkersburg Hydromatic Brakes, complete with fittings, at 50% discount. Box J-606, The Oil and Gas Journal, Tulsa, Oklahoma.

5½ KEYSTONE SPUDDER. Three strings of tools. New power unit. Forged, fishing tools. Two Trucks. Water-Tank Trailer. Lots Extras. $3,500. McLaughlin, 3506 W. Pikes Peak, Colorado Springs, Colo.

5½" OD CASING, 50,000' Seamless 10# with 10V New Threads and New Casing Collars, also 13# E.W. Casing 8RD Thread Range 2, Casing Collars, both hydrostatically tested. Other sizes of casing available from 4½" OD to 11¾" OD including 2⅜" OD and 2⅞" OD External Upset 8RD Thread and 10RD Thread Regular Oil Well Tubing, all brand new and tested. Immediate delivery from stock. Contact: Day: MOhawk 4-0870; Res.: FLanders 1-8152. A. J. Strubel, 4946 Murdoch, St. Louis 9, Mo.

96 FT. IDECO MAST on lowbed trailer, with or without Hopper hoist. 1705 Burton Way, Bakersfield, Calif.

TYPE EI GUIBERSON rotating pack-off head w/rubbers and casing adapter. Used for air drilling. A-1 condition. $700.00. Contact R. F. Mesker, GI 7-9483, Tulsa, Oklahoma.

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USED COMPRESSOR wanted for natural gas. Packaged unit. Maximum discharge pressure 200# with compressor cylinder 11" x 13" or equivalent. Notify E. R. Sink, operator, Route 3, Carthage, Texas.

HELP WANTED

ACCOUNTANT

Excellent opportunity in Tulsa for man with heavy accounting experience. Must know accounting for drilling business. Familiarity with tabulating equipment installations and procedures required. Please give details of education, experience and other personal information in first letter.

Box J-603,
The Oil and Gas Journal,
Tulsa, Oklahoma.

HELP WANTED

EXPERIENCED seismograph Party Chiefs, Seismologists, Chief Computers, Computers, Surveyors, and Observers by established and expanding Contract Seismograph Company. Salary commensurate with experience. State qualifications, references, and salary expected in first reply. Must be free to move with field party. Box J-591, The Oil and Gas Journal, Tulsa, Oklahoma.

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Experienced graduate engineers for immediate openings in Saudi Arabia and New York City. For engineering work in development, production, drilling, process, and oil and gas engineering on primary and secondary recovery problems.

RESERVOIR FLUID ANALYST

With degree in Physical Chemistry or Chemical Engineering plus 5 years' petroleum production engineering experience which should include 2 years' study of reservoir fluid behavior.

Salaries commensurate with training and experience. Write outlining personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 116

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Business Development

Large, internationally known engineering and construction firm has excellent opportunity for executive with proven record in business development in South America. Would work initially out of firm's Home Office ultimately opening branch office in South America.

Applicant should have at least 10 years' experience in engineering and construction; a good knowledge of the production, sales and fiscal aspects of the business; intimate understanding of contracts; and COMMAND OF SPANISH LANGUAGE.

Must have the ability and a past record of dealing with top people in government and private industry in developing large contracts. This executive will have the opportunity to build a business in South America to whatever size and extent capable and to administer the area operation.

Write: Box J-590,
The Oil and Gas Journal,
Tulsa, Oklahoma.

HELP WANTED

WANTED: PARTY CHIEF for aggressive contract company. Man with degree in geology or engineering and presently in position of Assistant Party Chief preferred. Box J-600, The Oil and Gas Journal, Tulsa, Oklahoma.

RESERVOIR ENGINEER five years experience. Salary open. Location Tulsa. Major company. Oil Industry Employment Service, 405 Tulsa Bldg., Tulsa, Okla.

PETROLEUM ENGINEERS

Major Oil Company has openings in Production Dept. in Venezuela for a number of graduate petroleum engineers.

OPENINGS also for petroleum, mechanical & chemical engineers for work in drilling, pipeline & gas depts. Salary commensurate with experience.

Please send details of Experience to:

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Unusual opportunity for professional growth and development for man as Chief Chemist in a large natural gasoline and sulphur recovery plant located in Tioga, North Dakota.

Work involved is not restricted by laboratory detail as operating and management duties are required.

Please include resume of experience and personal history in sufficient detail to justify personal interview to be arranged at your convenience.

SIGNAL OIL AND GAS COMPANY
ROOM 403
811 W. 7TH STREET
LOS ANGELES 17, CALIFORNIA

PETROLEUM ENGINEERS

Graduate Petroleum Engineers with 2-6 years' experience wanted by Major Oil Company for work in Mid-Continent and Gulf Coast areas. Openings available for Reservoir and Field Production Engineers. In first reply give resume of experience, date available, and salary expected.

BOX J-479, THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

OVERSEAS EMPLOYMENT OPPORTUNITIES

IRAN

with Iranian Oil Exploration and Producing Company and Iranian Oil Refining Company
(IRAN CONSORTIUM)

Attractive staff positions now available for qualified, experienced oil industry technical personnel:

DISTRICT PETROLEUM ENGINEERS
RESERVOIR ENGINEERS PRODUCTION ENGINEERS

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PROCESS ENGINEERS
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ELECTRICAL ENGINEERS & DESIGNERS
ELECTRICAL SUPERVISORS MECHANICAL SUPERVISORS
MECHANICAL ENGINEERS & DESIGNERS

Attractive salaries—liberal biennial home furloughs—family housing available within a reasonable period. Interviews will be arranged with qualified applicants.

WRITE
giving age, marital status, education, and details of experience
Box 308-A, Radio City Station, New York 19, N. Y.

HELP WANTED

OIL INDUSTRY Employment Service. 405 Tuloma Bldg., Tulsa, Okla. For technical, experienced oil men, under 40.

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

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FOREIGN EMPLOYMENT

Graduate Electrical, Mechanical, Civil or Chemical Engineers with minimum 10 years' experience supervising construction of industrial buildings, oil processing and oil handling facilities. Engineering degree essential. To assist in constructing expanding company facilities of major foreign operating oil company located in Saudi Arabia. Generous salary plus living allowance; liberal all-inclusive benefit program.

Write giving full particulars regarding personal history and work experience.

Recruiting Supervisor, Box 152

ARABIAN AMERICAN OIL COMPANY

505 Park Avenue
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CHEMICAL ENGINEERS AND PROCESS SUPERINTENDENT

COMMONWEALTH OIL REFINING CO., PONCE, PUERTO RICO

Require Process Engineers for technical service and process control in new completely integrated, modern refinery now expanding to 55,000 bbls. Equipment includes Catalytic Cracking, Reforming, Polymerization, Alkylation, Acid Regeneration, and SO_2 Treating.

Process Superintendent having experience to take full responsibilities of supervision of process operations.

Excellent opportunities afforded in new and growing organization. Liberal salary commensurate with qualifications.

Send full information to:

10 POST OFFICE SQUARE

Boston 9, Massachusetts

OPPORTUNITY FOR AREA ENGINEERS

The Parkersburg Rig & Reel Co. has immediate openings for young men interested in a career as Area Engineer. Duties would consist of studying existing producing equipment and recommending possible improvements in design, assisting in technical training of salesmen, and supervising installation and servicing of equipment. Degree in engineering or geology is required.

Openings also exist for BBA and Liberal Arts majors as sales trainees.

The salaries for the above positions will be commensurate with experience. Replies should include resume of education and experience, as well as salary requirements. Replies will be held in confidence.

B. C. BARRON

Parkersburg Rig & Reel Company

P. O. BOX 12007

FORT WORTH, TEXAS

HELP WANTED

DOWELL

Chemical Engineers
Mechanical Engineers
Industrial Engineers
Chemists

Unlimited opportunities for advancement—applied science and engineering sales. Fast-growing service company offering chemical cleaning (boilers, lines, process equipment) to all phases of industry. Locations through most of U. S. Car furnished after training program; retirement, vacation, insurance benefits; interesting, challenging work.

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Subsidiary of

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Design Engineers
Design Draftsmen

If you want

- HIGHEST EARNINGS
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- PERMANENT EMPLOYMENT
- OPPORTUNITY TO ADVANCE
- IDEAL WORKING CONDITIONS
- AIR-CONDITIONED OFFICES
- MANY OTHER BENEFITS

Please be sure to contact or see

Arthur G. McKee & Co.

with Engineering Offices in

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McKee is a 50-year-old Engineering and Construction firm doing business on a world-wide basis.

Interesting, well-paying positions for

DESIGNERS, ENGINEERS, DESIGN DRAFTSMEN and DRAFTSMEN qualified in

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The expanding McKee organization, with three engineering divisions, Refinery, Metals and Industrial, offers many interesting opportunities in these highly-paid fields.

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Please see or contact:
Edward A. Kelner

Arthur G. McKee & Company

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TOwer 1-2300

HELP WANTED

GEOPHYSICIST for review interpretation and supervision of seismic work for integrated oil company at permanent location. Please summarize education and experience background in first letter. Salary commensurate with experience. Box J-580, The Oil and Gas Journal, Tulsa, Oklahoma.

PARTY CHIEFS
SEISMOLOGISTS
COMPUTERS
OBSERVERS

WORLD-WIDE SEISMOGRAPH CONTRACTING ORGANIZATION

offers technical careers to qualified experienced applicants. Highly attractive starting salaries with good opportunities for advancement within both domestic and foreign areas.

United Geophysical Corporation

POST OFFICE BOX "M"
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Experienced in
OIL TOOL PRODUCT DESIGN

For work in design and development of new products for small but progressive specialty equipment manufacturer. A challenging job for a man with initiative seeking the satisfaction of successful exploitation and development of his ideas. Under 35 years preferred.

Interested in broadening present line of drilling equipment as well as diversification into other phases of petroleum equipment industry. Company's rate of growth (500% in 5 years) provides unusual opportunity for advancement to capable man. Immediate earnings commensurate with training and experience. Our men know of this ad.

Reply in confidence, giving complete details to

Box J-579, The Oil and Gas Journal, Tulsa, Oklahoma.

VALUATION ENGINEER

Oil Company seeking to purchase producing oil properties desires services of petroleum engineer with experience in reservoir valuation and appraisal work. In addition to practical technical knowledge and experience, must have ability to make and develop contacts. Some experience in the ABC economics of financing purchases also desirable. This is a permanent salaried position with excellent opportunities for growth. Written reply should furnish details on education, experience, age, personal and professional references, and some idea of salary requirements. Small recent photo would be helpful.

Box J-528, The Oil and Gas Journal, Tulsa, Oklahoma.

w

REFINERY OPERATORS

With minimum 7 years' oil refining experience. Must have experience on process units, such as crude distillation, thermal reforming, fluid catalytic cracking and reforming and thermal cracking. For refinery operation in Saudi Arabia.

Write outlining personal history and work experience.

Recruiting Supervisor, Box 136

ARABIAN AMERICAN OIL COMPANY

505 PARK AVENUE

NEW YORK 22, N. Y.

HELP WANTED

OIL COMPANY WANTS ENGINEERS

Excellent opportunity with well-known, aggressive company. Employment openings in Great Bend, Kansas and Midland, Texas for Junior Engineers. Applicant should have a degree, preferably in Petroleum or Mechanical Engineering, and not over 2 years experience. Write giving age, education and salary expected. Please address

ANDERSON-PRICHARD OIL CORPORATION,

Liberty Bank Building, Oklahoma City 2, Oklahoma, for the attention of Mr. D. F. Tver, Industrial Relations Department.

SENIOR GAS ENGINEER

Experienced in evaluating gas properties, designing and supervising construction of gas gathering systems and gas processing plants, for work with substantial Canadian independent owning in excess of 600 billion cubic feet reserves.

Salary and stock option commensurate with ability.

Apply giving detailed qualifications to:

Domo Exploration (Western) Limited

520 NINTH AVENUE WEST CALGARY, ALBERTA, CANADA

AREA ENGINEERS

Several graduate engineers with minimum 5 years' experience supervising maintenance engineering functions in oil refining or producing facilities, power plants, heavy industrial installations, manufacturing plants or related operations. To establish technical supervision, procedures, maintenance operations and schedule routine and special work for major oil producing and refining operation with all supporting facilities; i.e., housing, feeding, recreation, etc.

Salary commensurate with background and experience. Write giving full particulars regarding personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 64

ARABIAN AMERICAN OIL COMPANY

505 PARK AVENUE

NEW YORK 22, NEW YORK

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that approximately 320 acres of land in two parcels within the known geologic structure of the Hugoton field, Kansas, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre through sealed bids on or before 2:00 P.M., MST, August 7 1956, when bids will be opened. Details of the lease offering, and how and where to submit bids may be obtained from the Land Office, Cheyenne, Wyoming. Perry T. Williams, Manager.

HELP WANTED

Petroleum Geologists

Established Oil Company desires geologists for employment in West Texas area. Must know area and have four to six years of active experience in subsurface mapping and interpretation. Excellent opportunity for advancement. Salary will be commensurate with ability and experience. Reply should state age, education, experience, and salary desired.

BOX J-485,

THE OIL AND GAS JOURNAL, TULSA, OKLAHOMA.

SITUATIONS WANTED

PETROLEUM ECONOMIST - Statistician, B.A., 32, 3 years experience with major, desires responsible position domestic or overseas. Box J-583 The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST—ten years interpretation and field supervision. Desire position with oil company. Box J-503, The Oil and Gas Journal, Tulsa, Oklahoma.

PIPELINER-PRODUCTION MAN, 43, family man desires job with Pipe Line Co. or Independent Operator. 13 yrs. with major P.L. Co., 5 yrs. in production and superintendent in construction and operation of gathering systems. 23 yrs. practical experience. Would prefer work in Colorado or Rocky Mt. area. Box J-578 The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—Age 30, six years experience with major oil company, B.S. and M.S. degrees in petroleum geology. Experience in West Texas and Southeastern States. Married. Want job with progressive oil company or operator offering opportunity. Box J-581, The Oil and Gas Journal, Tulsa, Oklahoma.

POSITION WANTED: BS & LLB degrees, 32 months land department experience, 8 months private law practice, will go overseas. Duane Philis, Neenah, Wisconsin.

GRADUATE PETROLEUM ENGINEER, age 30, four (4) years field, secondary and reservoir experience with major in Oklahoma, Kansas and Texas. Desire general production engineering position with aggressive independent in Colorado or Oklahoma. Box J-601, The Oil and Gas Journal, Tulsa, Oklahoma.

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited.

Write, wire, or call collect for further information.

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146 Allen Building, Midland, Texas
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Experienced in top management planning, methods improvements, practical management controls, and all phases of accounting and treasury routines..

Can initiate ideas to Increase Profits, aid solution of top problems, direct administrative, finance and accounting activities.

Box J-607,
The Oil and Gas Journal,
Tulsa, Oklahoma.

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HIGHEST PRICES PAID for choice oil and gas income royalties, overrides, oil properties. A. S. Berry, P. O. Box 1383, Tulsa Oklahoma.

LEASE AND DRILLING BLOCKS

CONTACT A. L. BOWLES, Box 947, Ada, Okla., for Drilling Deals, Oil Production.

GRAYSON COUNTY ACREAGE for lease. Approximately 290 acres 3 miles SE Gunter, Texas. Contact R. H. Veazey, Van Alstyne, Texas.

FOR SALE: ½ of ⅞ working interest two wells sand production NE NE Section 19-4S-11E, White County, Illinois. B. L. Rucker, Telephone: 1072. Mt. Vernon, Illinois.

WE OFFER 240 acre drilling block in Pottawatomie County, Oklahoma. Five Year leases. Substantial dry hole contribution if well commenced within 30 days. Excellent possibilities for production in Earlsboro Sand, Misner Sand, Hunton Lime, Simpson Dolomite. 4700 feet test. Write Box 1360, Seminole, Oklahoma.

FOR SALE—A block of leases comprising 15,000 acres in the hottest spot in Collingsville County Texas. All new 10 year leases. Lots of activity. Your inquiry solicited. Box J-577, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: Producing oil and gas wells and leases located in Garvin, Stephens, Kiowa Counties, Oklahoma. For details call or write, Ralph W. Shebester, Box 337, Pauls Valley, Oklahoma. Telephone 570.

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Inquiries Invited

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One-Half Working Interest in responding water flood project, 4 adjoining leases, 400 acres, 13 wells, net recoverable oil reserves approximately 280,000 barrels. Coring and engineering data to principals only. Priced at $.30 per net barrel with 75% financing available. Fast liquidation for tax purposes. Details on request.

Box J-605,
The Oil and Gas Journal,
Tulsa, Oklahoma.

WELL RECORDS

FOR SALE OR LEASE, with agreement to maintain six year set of well-completion cards covering Kansas, Oklahoma, North and West Texas. Box J-606, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION WANTED

$40,000,000 TO INVEST in oil production, any part over $1,000,000, give full report. TJADEN, Eagle Lake Texas.

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360 Forest Ave., Apt. 605
Palo Alto, California.
Will be shipped prepaid.

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VENEZUELAN OIL SCOUTING AGENCY. Periodic reports—maps—newsletter. Mail: VOSA Apartado 3963, Caracas. Cables: VOSA, Caracas. Telephone 544802. Neal VanMiddlesworth.

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DOWN TOWN LOCATION Casper, Wyoming. Office building, warehouse and material yard, all or part. Casper Realty Company, 300 North Center, Phone 2-7345, Casper, Wyoming.

MOTELS. Income and a choice assortment of Wyoming's best cattle ranches. Casper Realty Company, 300 North Center, Phone 2-7345, Casper, Wyoming.

BUSINESS OPPORTUNITIES

HAVE CAPITAL available to develop oil properties for participating interest. Box J-512, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Responsible party to share development of 140 Acre Oil-Gas lease, and to finish started well; marketing facilities available in Southern Pa., Northern Md. Section; Will cooperate in any way possible. Write: Oscar Lohman, c/o Tonoloway Petroleum Corporation, Box 280—Rt. #1, Clearspring, Md.

WILL ASSIGN undivided half interest 40 acres for well drilled and equipped offsetting 25 bbls. per hour natural. Five other pay sands. Phone RI 2-4533, Tulsa.

CAPITAL CONTACT. Will consider placing proposition requiring corporate financing on Underwriting basis. Confidential. Write Consultant, 817 51st St., Brooklyn, N. Y.

GEOPHYSICAL CONSULTANT desires challenge to improve shooting results in marginal and no record areas. Techniques proven. Phone TErminal 4-4244. O. G. Singleton, 5117 Mallory, Fort Worth 11, Texas.

I HAVE GOOD OIL SHOWING 400 ft. Oil & gas seepage on properties. Possibility oil 1000 ft. Financing needed. Write P. O. Box 2047, Parker, Arizona.

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Experienced Oil Drilling Co.—owning producing oil leases—will drill you a diagonal offset well—495' from well flowing 30 barrels daily—Burgess sand—1600'—in Tulsa County, Oklahoma,—at actual cost—providing you equip and complete well into tank and pipeline—for a one half interest. Your total cost $15,000.00. Additional offsets available.

BOX J-585,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

PRODUCTION WANTED

WANT TO BUY—Oil Properties, settled or semi-settled production, 100 to 5,000 barrels daily in Oklahoma and Kansas. Contact Morris Sitrin, 1215 First National Building, Tulsa, Oklahoma.

WANTED

WILL BUY 200 to 3,000 bbls. settled Oil Production any place. Box J-604, The Oil and Gas Journal, Tulsa, Oklahoma.

WILL PURCHASE shallow production, working interests, overrides, royalties, good pay-outs. P. O. Box 1467, Midland, Texas.

WANTED CAPITAL: To drill Oriskany sand well to 6900 ft. in newly discovered Penn Gas Field. This lease is high on structure. Located between 2 discovery wells. Cost $80,000. I have ⅜ of drill costs. Will sell ⅜ at $10,000 each or $2,500 per ⅛nd. Production almost a certainty, pays 27½c per thousand. Must drill in next 30 days. No allowables. Box 22, Emmaus, Pa.

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that approximately 798.72 acres of land in four parcels within the known geologic structure of the Big Muddy Field, Wyoming, and approximately 440.15 acres of land within the known geologic structure of the Lance Creek field, Wyoming, in six parcels, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre through sealed bids on or before 2:00 P.M., MST, August 15, 1956, when bids will be opened. Details of the lease offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Perry T. Williams, Manager.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Salt Lake City, Utah. Notice is hereby given that approximately 80 acres in two parcels: Parcel #1: SE¼ NE¼ Sec. 14, T. 41 S., R. 12 W., S.L.M., Utah, containing 40 acres; Parcel #2: NW¼ NE¼ Sec. 23, T. 41 S., R. 12 W., S.L.M., Utah, containing 40 acres, within the known geological structure of the Virgin Oil Field, Utah, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre at 1:00 p.m. M.S.T. August 7, 1956, when bids will be opened. Details of the lease offering, how and where to submit bids, may be obtained from the bureau's Salt Lake City, Utah, Land Office. Ernest E. House, Manager, Land Office, Salt Lake City, Utah.

LEGAL

SEALED BIDS will be received until 2:00 o'clock P. M., Central Standard Time, July 26, 1956, and opened at that time in the Office of the Superintendent of the Pierre Indian Agency, Pierre, South Dakota for the leasing of 2,911.23 acres of Tribal land and 5,579.59 acres of allotted Indian land, located in Township 105 North, Range 72 West, Township 106 North, Ranges 71, 72, 73 and 74 West, Township 107 North, Ranges 73 and 74 West, Fifth Principal Meridian, Lyman County, South Dakota for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Pierre Indian Agency, at Pierre, South Dakota.

LEGAL

SEALED BIDS will be received until 2:00 P.M., Mountain Standard Time, July 17, 1956 and opened at that time in the Office of the Uintah and Ouray Indian Agency, Fort Duchesne, Utah for the leasing of 466.29 acres more or less, of Allotted Indian lands in two separate parcels located in Sections 12, 14 and 15, Township 6 South, Range 22 East, Salt Lake Meridian, Uintah County, Utah, for oil and gas mining purposes. The details of the lease offering and filing of bids may be obtained by addressing an inquiry to Mr. John O. Crow, Superintendent, Uintah and Ouray Agency, Fort Duchesne, Utah or to the Regional Oil and Gas Supervisor, U. S. Geological Survey, Casper, Wyoming.

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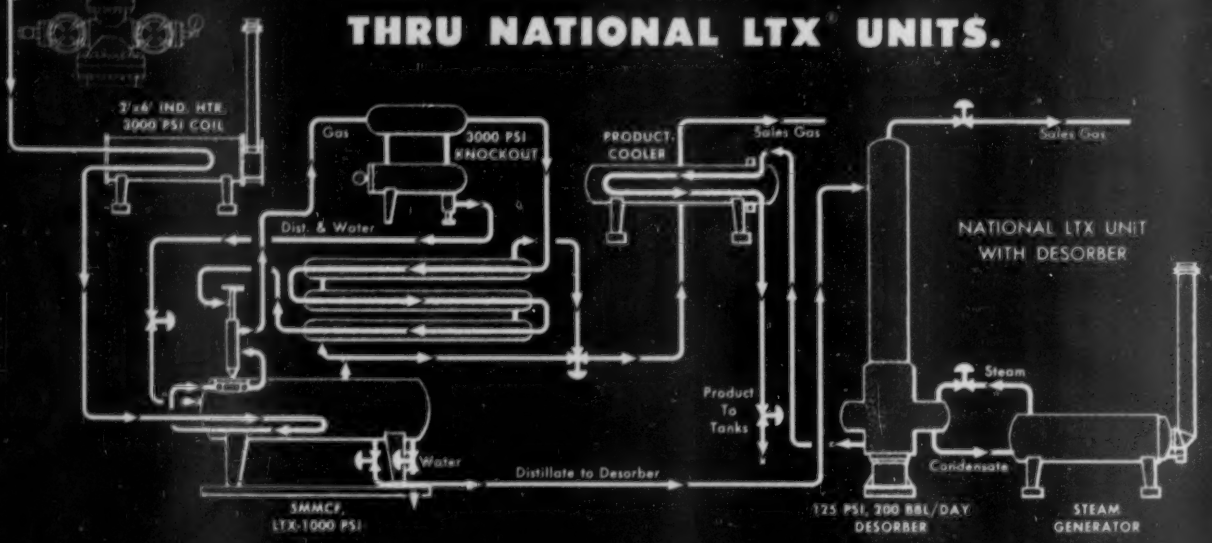

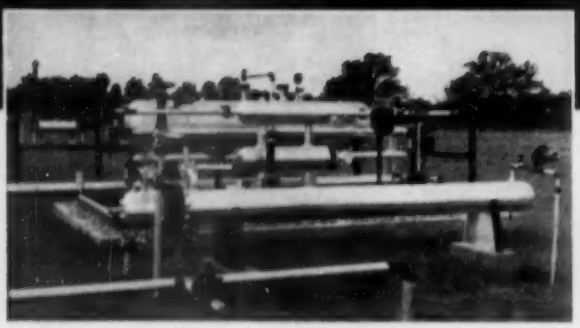

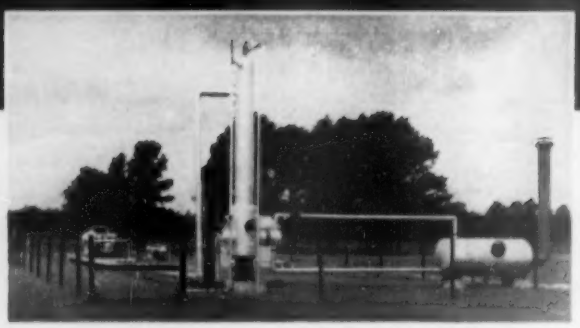

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